PUBLIC HEALTH

REPORTS AND PAPERS

VOLUME IV

PRESENTED AT THE MEETINGS OF THE

American Public Health Association

IN THE YEARS

1877–1878

WITH AN ABSTRACT OF THE RECORD OF PROCEEDINGS

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INTRODUCTORY NOTE.

BY THE SECRETARY.

THE fourth volume of Papers and Transactions of the American Public Health Association comprises the principal contributions and an abstract of the proceedings at the annual meetings in 1877 and 1878.

The events which, in these two years, as well as in the four previous years, in some degree diverted the members of the Association from those specific studies and investigations that, in 1872, were devised for promoting sanitary knowledge, have not in the least delayed the attainment of the main results sought in the original organization of this body and its numerous voluntary committees. Broad and progressive as the purposes and methods of the Association were at the outset, the events of the six years have traveled more rapidly than our thoughts; and it now appears that the hopes, purposes, and coöperative spirit which so recently seemed to be limited to a small number of workers in the fields of public hygiene have come to be shared by thousands. The work undertaken by the voluntary committees was not neglected; for, upon twenty-two of the twenty-six subjects that members elected to study and report on, valuable reports and papers have been received and published; but such has been the course of events that the public demands for sanitary works have compelled the practical hygienists of our country to apply their knowledge and all available resources of sanitary science directly to the most practical improvement of the public health. The two or three well organized sanitary departments in cities have begotten their like in nearly fifty municipalities, and the two or three State Boards of Health have been increased to twenty-one in number, while their laws, and the methods by which the civic and State sanitation are promoted and sanctioned, have been improved commensurately with the extension of this domain of hygiene.

This Association being ever active in its pioneer service, and with a selected membership in all States of the Union, its annual meetings have become open Sanitary Conferences for the nation, and the discussions necessarily exceed the range of demonstrated propositions and matured reports. The varied observations and experience of sanitarians and health officers, their divergent or conflicting opinions and conclusions, the questions, doubts, and incomplete studies which must be admitted for practical discussion in these yearly conferences abundantly prove how important it is, not only to incite the inquiries which yield these results, but also to confront errors in theory and practice, and induce the adoption of exact and well demonstrated conclusions and practical measures in all that relates to the organization and methods of public health care. The six annual meetings, and the successive volumes of Transactions of the Association, have borne the impress of this conservative design of the discussions, as well as of their freedom and practical scope.

To the excellent work and influences of the State Boards of Health, and to the steady maintenance of sanitary studies and records by the Medical Departments of the Army, the Navy, and the Marine Hospital Service, are due the credit of enhancing the objects of the Public Health Association and its publications, as the continued contributions from prominent officers of those branches of the national service bear witness; and this continued interest on their part and the manifest nationality of the present relations and work of this Association, clearly indicate the necessity and practicability of a National Sanitary Service. Continued friendly conference and coöperation between all persons whose duties and endeavors should be given to protect the national health and promote sanitary knowledge must be regarded as a precurser and promise of support of a National Board of Health.

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BY WIRT DEXTER, ESQ.,
Counselor at Law.

GENTLEMEN OF THE AMERICAN PUBLIC HEALTH ASSOCIATION, — I understand that your first purpose is to study the causes of disease and suggest methods of prevention.

We are fast coming to understand that the prevention of disease means wealth and prosperity, and that, aside from those high and sacred considerations which move the heart of man to alleviate the sufferings and obstruct the evils that afflict his fellow-man, there is a sharp pecuniary side to your efforts, which, as true citizens of Chicago, we are not at liberty to overlook.

It may be unfortunate, but I am afraid it is true, that an abstract discussion of life and death, health and sickness, would not much arrest our attention. As here where the race of life is so ardent and profitable, — more, perhaps, than elsewhere, — men think all men mortal but themselves; but when it appears that your science comes to the little trader as well as to the wholesale merchant, in suggestions of increased trade; that it speaks to the hotel-keeper of multiplied guests; that it runs with the railways centering in our city, then we have time, then you touch our hearts and suffuse our eyes, then we embrace you.

I read in one of your interesting reports that the small-pox scourge of 1871–72, cost the city of Philadelphia over twenty-one million of dollars. The facts given, I think, warrant the conclusion. This was manifested in diminished travel and shrunken commerce. Nor is this all; for it appears that this great sum might have been saved, to say nothing of the lives lost and the suffering endured. We rejoice this year in a most bountiful crop, but there are other sources of wealth, quite as visible and more certain than corn and wheat, that do not attract our attention.

Our city has been in commotion for thirty days about the truly serious loss of four or five million dollars by our savings-banks, but we probably annually lose a much greater sum in our indifference to sanitary measures, and without excitement, and almost without protest.

There is not within the limits of Chicago a business uninjured, a palatial residence or a cottage the value of which is not diminished, by the pestilent odors that sweep over our city. Yet men, busy in their own affairs, who pass for sagacious, far-seeing men, act as though it were no concern of theirs, — no concern of theirs as to the drainage of houses two blocks away, no concern of theirs whether the air common to all becomes polluted; but typhoid and scarlet fever among their loved ones at home utter a mournful denial of these assertions. And thus you will prove that the widest traffic, the most permanent prosperity, and the largest security for the home are founded on the truth that man is his brother's keeper. Gentlemen, it is your mission to reënforce the higher duties of life among men by those most potent arguments of personal gain and interest; it is for you to teach the mere man of affairs that an intensified and narrow view is in the long run a losing one. You are to instruct the absorbed capitalist, ever eager to increase the permanency of his possessions, that in an active attention to the material condition of those around him rests the most continuing prosperity for himself. And thus you purify and render unselfish the heart of man in the same ratio that you advance his material condition. Gentlemen, in the name of our people, I bid you welcome, and express their kindest wishes for a satisfactory progress of your deliberations.

II.

THE SANITARY PROBLEMS OF CHICAGO, PAST AND PRESENT.

AN INTRODUCTORY DISCOURSE, CHICAGO, SEPTEMBER 25, 1877.

By J. H. RAUCH, M. D.,
President of the Association.

It is interesting to notice how little the elements of mere beauty of location, or healthfulness of surroundings, as things worthy to be considered, enter into the locating of towns which, in the usual growth of business and population, become large cities. Facilities for primitive trade and barter are the elements which generally first determine the sites of future cities. Careful selection of a site with reference to the wants of a large population from the necessities of the case cannot be made, and in many instances where it was supposed all the conditions obtained, failures have occurred. The sanitary problems that subsequently arise unite the necessity of accepting its deficiencies in regard to water supply, to soil, to atmosphere, to location and topography, with that of applying such artificial remedies and modifications as may be appropriate and practicable.

Marsh, in his work on "Man and Nature," says, "The influence of man in changing the climate and the physical condition of a country needs no argument to substantiate it." Withdraw man, and you remove the disturber of all laws. People must be "awakened to the necessity of restoring the disturbed harmonies of nature, where well-balanced influences are so propitious to all her organic offspring; of repaying to our great mother the debt which the prodigality and thriftlessness of former generations have imposed upon their successors, thus fulfilling the command of religion and of practical wisdom, to use this world as not abusing it." He further says, "I am satisfied that we can become the architects of our own abiding place, as it is well known how the mode of our physical, moral, and intellectual being is affected by the character of the home Providence has appointed, and we have fashioned for our own material habitation."

Such is undoubtedly the case, and it becomes our duty as far as possible to restore this harmony which is destroyed by the accumulation of human beings. The collection of many people in a small space, no matter for what purpose, is unnatural and artificial; and it is therefore necessary, in order to prevent the ill effects of such accumulations, to resort to artificial means of neutralizing the disturbing agencies.

THE NATURAL CONDITIONS. — THE LOCATION AND TOPOGRAPHY OF CHICAGO.

Up to the date when this town (Chicago) was laid out, in 1833, the territory now comprised in the limits of the city and its surroundings was occupied chiefly by the Indians. The Jesuit missionaries Marquette and Joliet were attracted to the settlement at the mouth of "the creek," upon the shores of Lake Michigan, the future site of Chicago. Later we find a trading post for barter and traffic between the Indians and venturesome and ambitious white men, who were willing to be pioneers upon the frontiers of the country, and in advance of civilization and of the government. Soon there was established a military post for the protection of the early settlers; and, indeed, it is not very many years since the last log-building, composing a part of old Fort Dearborn, and located near the present Rush Street Bridge, was torn down.. The fact, too, that during certain seasons of the year communication could be had in early days from Chicago, by means of boats and canoes, with the Indian villages along the Des Plaines and Illinois rivers, and thence with the settlements along the Mississippi River, was an additional feature which contributed to determine the site of the future metropolis of the Northwest.

When this territory was first settled nearly the whole "divide" between the waters of the St. Lawrence and the Mississippi was frequently covered by water. Until a recent date, freshets and overflowing of large areas of territory adjacent and tributary to the early town of Chicago were of very common occurrence.

This condition of the surrounding country can be better appreciated by bearing in mind that the original site of Chicago[1] was upon land lying flat and low, a level and, comparatively speaking, treeless plain, much of it marshy, and with but slight dip towards either the sluggish river or the neighboring lake. Indeed, the highest point above the level of Lake Michigan, for fifteen miles north, is only 38 feet, and southeast, for the same distance, only 23 feet.

Directly south of the city, the surface is almost level, as the highest point in sixteen miles is only 22 feet. The topography southwest is still more remarkable, as for ten miles the highest point above the level of the lake is only 10 feet at the Summit, where the waters of the St. Lawrence run northeast, and those of the Mississippi southwest. From the Summit there is a gradual descent, until the ground is lower than the surface of the lake. At twenty miles, it is only one foot above the lake.

Three miles directly west, the surface is 17 feet; five miles, 20 feet; and seven miles, 27 feet. At Austin, where no doubt was once the shore of the lake, and continuing two and a half miles further, to Harlem, we find an elevation of 48 feet, the highest point in any direction within ten miles of Chicago. Thence to the Des Plaines there is a descent, the bottom of the river being 26 feet; there is then a marked increase in the ascent,

[1] Chicago is situated in latitude 41° 52′, longitude 78° 35′, and is 591 feet above the level of the sea.

so that at fifteen miles the surface is 102, and at twenty 125, feet above the level of the lake. Northwest of the city, at four miles, we find an elevation of only 10 feet; at seven miles, of 27 feet, where we again strike the original lake shore; at ten miles, 40 feet; at eleven miles, 65 feet; at twelve miles, 82 feet; from this point there is a gradual descent to the Des Plaines River, where the elevation is 33 feet; thence the ascent is gradual, and at twenty miles it is 96 feet.

It will be seen from the foregoing that the highest point within five miles from the mouth of the Chicago River, in any direction, is only 23 feet, and for ten miles 48 feet, above the level of the lake; and that a large portion of this ground was originally low and swampy, with but little surface drainage and an average elevation of about 12 feet only.

As a necessary consequence, as in all plains, great and sudden changes of moisture and temperature take place. So far as regarded its sanitary and topographical features, such was the natural condition when Chicago was located. The winds, meeting with no obstructions, had full sweep. The only interruption to the winds in this open plain might be said to be the narrow belt of timber on the Des Plaines River, with here and there an occasional patch of thinly covered woodland on the elevations which once were the shores of the lake. With these exceptions, the open plain is continuous for a great distance northwest, west, and southwest. It is true, timber is scattered north and south, but, unfortunately, there is not enough to materially influence the climate, in addition to the fact that the winds are rarely from either of these directions.

In an area of four hundred square miles surrounding Chicago, there were only about twenty-five square miles which were thinly covered with timber: ten of these were found on the north side of the city, and along the north branch of the Chicago River; five south and southeast; and ten on the ridges six miles west, and in the valley of the Des Plaines River.

THE GEOLOGY OF THE SITE OF THE CITY.

The geological structure of the region embracing Chicago and the surrounding country is exceedingly simple.

The underlying rock is the Niagara limestone, which has a general dip N. N. E., and consequently sinks deeper as traced lakeward.

Upon this floor was originally deposited a mass of blue clay, not less than 100 feet in thickness; but as traced towards the former rim of the lake, it rapidly thins out.

This rim is clearly defined in one or more terraces, which are traceable from the head of the lake far into Indiana. To the west of the city, however, eight and a half miles distant, at Harlem, they constitute the "divide" between the waters of Lake Michigan and the Mississippi.

While the lake has receded far below its former level, it has left behind a series of sand ridges, the intervals between which were occupied by ponds, which, by reason of the sluggish flow of the water and their sheltered position, have proved favorable to the growth of the peat-producing plants, from whose decay have resulted large accumulations of humus, or vegetable matter. It is upon this ancient lake-bed that Chicago was founded.

The original surface was diversified by sand-banks, most numerous along the lake shore, extending occasionally to the depth of sixteen feet; by partly filled lagoons, and by a vegetable mold (which covers the greater portion of the city), resting sometimes on blue clay, and sometimes on beds of sand and gravel, and occasionally mixed; the depth of these varying with their proximity to the Chicago River and its branches. The whole region, as before remarked, was originally low, flat, and ill-drained. Some of the business blocks at the present time are built upon partly filled lagoons. In the soundings made, preparatory to the construction of the Lake Tunnel for the Water Works, it was found that the lake-bed was composed of blue clay, with superficial sands above, which shifted in heavy storms. Such a soil must necessarily exercise a decided influence upon the health of those living upon it, depending, of course, upon the question whether their houses rest upon sand, clay, or humus.

THE INFLUENCE OF LAKE MICHIGAN ON HUMAN LIFE.

Of all the local conditions that obtain at Chicago, none exercise a greater influence on the climate than Lake Michigan. It moderates the extreme cold of winter and the oppressive heat of summer; increases the humidity of the atmosphere and the quantity of rain that falls; and causes local currents of air, thus partially changing the prevailing winds of this latitude, producing necessarily local changes of temperature. These local undulations are most marked in the spring, owing to the fact that the specific heat of the land is only one quarter that of the water, and is both absorbed and given out more rapidly; while water, on the other hand, absorbs it more slowly, stores up a greater quantity, and parts with it slowly, owing, no doubt, to the difference in their conducting and radiating properties. It is mainly due to this fact that our springs are so cold, raw, and long continued; that is, the water is not as soon heated as the land, thus giving rise to local changes of temperature and of winds. In the autumn, the heat of the water is less readily abstracted than that of the land, thus causing the temperature in the immediate vicinity of the lake to be milder than even at localities further south and west. The mean temperature of the lake is no doubt the same as that of the land for the year, differing only in the absorbing and parting power of heat, as is evidenced by the fact that the freezing point obtains only a short distance from the shore. It will therefore be seen how for eight months of the year, and sometimes even for nine, the lake exercises a wholesome influence upon health, counteracting, to some extent, the great and sudden changes incident to our level and open topography, while, during the remaining months, it is injurious to health, on account of the cold and chilling effect it has, in addition to causing sudden changes. Its agency in purifying the atmosphere by absorption it is hardly necessary to dilate upon in this connection.

THE INFLUENCE OF THE WINDS.

We come now to consider the winds. They are the result of changes of temperature and the precipitation of moisture, acting as changes of density, and as the movements of bodies would act to produce currents and movements in a mass of water.

The free movement of air in summer, in certain localities, is beneficial in dissipating noxious emanations and purifying the atmosphere, while in the same locality, in the cold season, it abstracts heat, in proportion, of course, to its velocity and humidity, and thus often acts injuriously upon life. The seeds of disease are frequently wafted by winds from unhealthy localities, and thus endanger those who live quite remote from the local cause itself.

Fevers and acute pulmonary and inflammatory diseases do not usually manifest themselves under the influence of the same wind, although fever and certain other diseases may occur in connection with any currents which waft the air from the neighboring surfaces, where the elaboration of a morbific cause is going on.

The north wind, which is less frequent than any other, generally exercises a beneficial influence, and in winter is the mildest, with the exception of the southeast and east winds. This wind, like all others, is influenced by locality in its effects upon health.

The northeast wind of March, April, and May, is cold and moist. This wind increases pulmonary, rheumatic, and inflammatory diseases in the spring months; but during the summer months, when the heat is extreme, or in winter, when very cold, it is beneficial and salutary.

The east wind, with the exception of the north, is the least frequent, and is more common in the spring than at any other season of the year. In the winter it is warm, and when it prevails there is a diminution in the number of cases of acute inflammatory disease. The lake exercises a marked influence upon this wind and that from the northeast.

Of all the winds, none is so depressing and enervating as the southeast wind. It is oppressive to man and beast, in consequence of checking evaporation, thus raising the temperature of the body, and causing the lungs to exhale a larger amount of carbonic acid than usual, and in this way exhausting the vital energies. The topography of the country south and southeast of the city is such as to promote currents of air from this direction, and to direct them toward the city. When the weather has been intensely cold for a number of days, a change to the southeast wind will diminish the mortality, but for at least nine months in the year it is the most fatal wind that we have in Chicago. The south wind is more common than either the east or the north wind. In winter the south wind exercises a beneficial influence in moderating the extreme cold of the westerly winds, diminishing the mortality, and the same result is observable in the spring.

The prevailing wind, not alone of Chicago, but of the greater portion of the valley of the Mississippi, is the southwest wind; if long continued, it produces harshness and dryness of the skin and general malaise. It partakes of the character of the country, and of the seasons. This wind, sweeping over a greater unbroken expanse than any other, necessarily exercises a great influence upon health, in addition to its wafting the malarious exhalations of Mud Lake and the region contiguous to the Illinois and Michigan canal over every portion of our city, and next to the southeast is the most fatal, and causes the greatest mortality. There are years in which this is the hottest wind, and again it is the coldest.

The west wind is more common than any from the direct points of the compass; is most frequent in winter, when it is the coldest and driest. The greatest mortality, when this wind prevails in winter, is by acute inflammatory diseases. In the summer its influence is marked by a great diminution in the number of deaths. It may be said to be the healthiest wind during the entire year.

The northwest wind is cold, keen, and penetrating in winter; in the spring cold, blear, and bleak; and in summer cool and refreshing. It is of about equal frequency during the winter, spring, and autumn months, being least prevalent in summer. Its injurious effects are strongly marked in winter, and particularly in the spring, when it causes great changes of temperature, resulting in pulmonary, rheumatic, neuralgic, and inflammatory affections; while in summer it diminishes the rate of mortality, and exercises a wholesome influence upon the general health.

THE TEMPERATURE.

Owing to the open and treeless plain upon which it is located, and by which it is surrounded, the consequent exposure to the winds, and the evaporation from the lake, Chicago is subject to very frequent and sudden changes of temperature. From observations made at Fort Dearborn, extending from 1832 to 1836, the annual mean temperature was 46.7° F., and from 1866 including 1876 49.5° F., which shows that the temperature is gradually becoming higher.[1] As a rule, January is the coldest month, February and December are next; while July is the hottest, and August and June are next so. The extremes of temperature are not as great here as they are farther west, and at points remote from large bodies of water. The climate may be said to be semi-continental. By way of comparison with other localities, it has been found from observations made for a series of years that the range of temperature at St. Louis is 125° F.; at Prairie du Chien, 132°; at Rock Island, 120°; Fort Snelling, 140°; Council Bluffs, 129°; Detroit, 107°; Toledo, 103°; Lansing, Mich., 107°; Mackinaw, 117°; and Chicago from 1832 to 1836, 116°, and from 1866 to 1870 inclusive, 111°. Since the latter period it has come down to 107°, showing that the climate is becoming more equable, and that the alternations of heat and cold are not as great as when the place was first settled.

THE RAIN-FALL.

The amount of rain that falls is an important factor in the healthfulness of a locality, especially in one like that of Chicago. Here, as elsewhere, there are annual fluctuations of mortality, independent of epidemics.

[1] For 1877, 50.3°; for 1878, 51.8°.

The months of July, August, and September are those in which the lack of drainage has been most marked in its influence upon human life, especially in cases of children under five years of age. The following table will show that the death-rate has tallied with the rain-fall during these months from the year 1866 to 1872 inclusive : —

Year.	July, inches.	Aug., inches.	Sept., inches.	Total 3 mos., inches.	Total year, inches.	Death-rate per 1,000.
1866	3.58	7.84	6.53	17.95	36.65	32.22
1867	1.51	2.32	.40	4.23	21.26	21.16
1868	3.86	3.58	7.08	14.52	37.33	23.74
1869	3.21	1.38	.89	5.48	31.66	23.16
1870	3.71	2.17	2.82	8.70	23.62	24.53
1871	2.56	.50	.10	3.16	32.85	21.46
1872	4.05	2.56	6.43	13.04	28.94	27.61

The mean annual rain-fall at Milwaukee for twenty-five years was 30.20 inches ; at Toledo for six years, 38.94 ; at Lansing for four years, 30.56 ; and at Chicago from 1866 to 1874 inclusive, 30.84 inches.

I have also observed that there were greater annual fluctuations at Chicago than at the other points mentioned, all being within the thirty-inch rain-belt. The difference is also greater in the summer. Since 1874 there has been a marked increase in the number of inches that fell at Chicago, so that for the last four years we have had 41.93 inches. Attention is called to the following table, showing the chief causes of death for the year 1872, nearly all the decedents being under five years, and showing how the rain-fall and temperature affect infantile life. Nearly one half of all the deaths during this period resulted from the six mentioned diseases.

	April.	May.	June.	July.	August.	Sept.	Total.
Cholera infantum	6	10	146	549	530	187	1,428
Convulsions	94	71	101	112	116	81	573
Diarrhæa	8	5	53	73	132	63	384
Dysentery	2	3	26	38	63	30	162
Tabes mesenterica	8	14	21	40	38	27	148
Teething	3	14	16	25	34	14	106
Total	121	117	363	837	913	402	2,801
Mean daily temperature, degrees.	48.6	57.5	70.2	72.5	72	94	
Rain-fall	2.99	3.28	3.41	4.08	2.56	6.43	

THE ARTIFICIAL CONDITIONS.

I have thus far described the natural conditions surrounding Chicago, and will now briefly call your attention to what has been done to improve its sanitary condition. The question of the water supply first attracted attention, as will be seen by the following : —

[1] In 1878, 48.84 inches fell, a greater amount than has fallen in any year since 1832, and probably than ever before.

THE WATER SUPPLY OF THE CITY.

During the prevalence of cholera in 1849 and 1850, it was observed that nearly all who drunk the water of a certain well on North La Salle Street, died. This of course attracted attention, and was supposed to be owing to the fact that the well received the drainage from privies in the neighborhood, and in this way infected those who drunk the water. This was true; but I found afterward that in this neighborhood the soil was stratified by thin layers of blue clay, which is impervious to water, and whenever these layers were penetrated by wells they acted as drains for a great area, the remaining portion of the soil being composed of sand until the thick stratum of blue clay underlying the greater portion of the city was reached. My attention was first called to this fact in the City Cemetery, while I was investigating the subject of intramural interments, in 1859. I here found in certain portions of the ground, particularly that adjoining Clark Street, and supposed to be the highest and best for burial purposes, at a depth of about two and a half feet, a stratum of blue clay about six inches thick, the overlying stratum being composed mostly of humus and of sand. The blue clay penetrated, sand was again found to the depth of five feet, the required depth of graves in this cemetery. After a heavy rain-fall, water had to be dipped out of the grave while the digging was in process. I also noticed, in a number of instances, that when the graves were finished but little water was found in them, while in the course of an hour or two they were filled to the upper edge of the blue clay. In one case, in a space where no graves had been dug before, I saw the water running through into the opening after the blue clay was cut.

The effect of drinking well-water was so marked during the prevalence of cholera in the years mentioned, compared with that of drinking lake water, which was supplied to a small number of inhabitants by the Chicago Hydraulic Company, a private enterprise, that an act was passed, on February 15, 1851, by the legislature of Illinois, incorporating the Chicago City Hydraulic Company. This was the commencement of our present magnificent system of water supply, which has grown with our needs and necessities; and it is not presumptuous to say that at this time the supply of water is as great and good as that of any large city in the world.

THE DRAINAGE OF THE CITY.

The necessity of the systematic drainage of Chicago was not fully appreciated until it had suffered from epidemics for six years in succession, five of cholera and one of dysentery; the death-rate during this period being higher than that of any other city in the United States. As the result of this terrible experience, on February 14, 1855, an act was passed by the legislature of Illinois creating the Board of Sewerage Commissioners. In compliance with the act, the commissioners were elected as prescribed, and steps immediately taken to give practical effect to the same in surveys, and in the consideration of plans for the drainage of the city. The plan proposed by E. S. Chesbrough, Esq., was adopted in December, and in 1856 the work of constructing sewers commenced. This has been mainly adhered to since, and prosecuted with varying vigor and effect, as will be seen by the following table, showing the number of feet built annually, the population, the mortality, and the death-rate per thousand: —

Sewerage.

Year.	Number of Feet of Sewer Built.	Population.	Deaths.	Death-Rate per 1,000.
1856	31,794	84,113	2,086	24.80
1857	25,681	93,000	2,414	25.66
1858	101,879	84,000	2,255	26.84
1859	55,208	96,000	2,008	21.36
1860	69,024	109,260	2,264	20.70
1861	2,826	120,000	2,279	18.99
1862	15,685	137,030	2,835	20.69
1863	39,605	150,000	3,875	25.83
1864	25,021	161,288	4,448	27.57
1865	29,948	178,492	4,029	22.57
1866	48,127	200,418	6,524	32.22
1867	89,661	225,000	4,648	21.17
1868	47,841	252,000	5,984	23.74
1869	139,705	280,000	6,488	23.16
1870	78,166	299,227	7,343	24.53
1871	50,392	325,000	6,976	21.46
1872	57,342	367,293	10,156	27.60
1873	47,342	385,000	9,557	24.82
1874	146,702	395,409	8,025	20.29
1875	222,322	405,000	7,899	19.50
1876	120,971	415,000	8,573	20.65
1877	64,666	434,000	8,026	18.24

For the purpose of more clearly showing the influence upon life of this, the most important sanitary movement ever inaugurated in this city, I would call attention to the fact that the mean annual death-rate from 1843 to 1856[1] was 37.91 per thousand, while from 1856[2] to 1870 it was only 23.97, and from 1870 to 1877 inclusive 22.13.[3] The last period includes the effect upon life of the "great fire," and also of an epidemic of scarlet fever.

The following will more fully explain how drainage acts beneficially in this city.

I have found, in judging of the comparative healthfulness of different wards, that the soil affects health by its conformation, elevation, and mechanical structure, — conditions which influence absorption and radiation of heat, reflection of light, absorption, retention, and movement of water over and through it, in addition to the passage of air through the soil. The soil

[1] This is still more marked when it is borne in mind that up to this date there was a great excess of adults, as is always the case in a newly settled country or town.

[2] The year when sewer construction commenced.

[3] Including 1878, the death-rate would be 21.51.

may also affect health by its chemical character, which acts especially by altering the composition of the air over, or the water running through it. In this way, in addition to its natural character, the decomposition of organic matter affects the atmosphere or the water, and this is particularly the case when houses are located upon the ground, where, owing to the influence of temperature and moisture, septic gases are generated and pent up, and thus exercise an injurious effect upon the occupants of such towns. It is therefore a matter of great importance to keep the ground under buildings as dry as possible, to prevent the formation of noxious gases, particularly where the sun and air have no direct influence.[1]

In Chicago this can be accomplished only by thorough surface and subsoil drainage.

"The heat of the sun is absorbed in different amounts by different soils equally shielded. Color and aggregation seem chiefly to determine it. Loose and incoherent sands are the hottest, while compact and clayey soils are the coldest. The absorbing and radiating powers of soils are not necessarily equal, though they may be so. Generally, the radiating power is more rapid than the absorbing, — soils cool more rapidly than they heat. Here the sandy soil is the most healthy, while the clayey soils are damp and moist, and naturally productive of certain classes of disease.

"It has also been observed that some soils absorb and retain moisture more than others. Sand absorbs and retains but little water, clays from ten to twenty times more, and humus, or common surface soil, more than fifty times as much as sand.[2]

"Clays sometimes contain as much as ten per cent. of water by weight, and thus are injurious to health in two ways by being moist, and, although they contain but little organic matter, the moisture aids in its decomposition, and thus they are malarious."[3]

In any depression into which there is drainage, no matter what the character of the soil, there is danger to health. Even sandy soil may be damp from this cause, the water rising through the loose particles from the pressure of higher levels; or, as is frequently the case in this city, there are pockets of sand into which the drainage of the surrounding soil collects; or an impervious clay is found forming a basin without an outlet, where the water collects and remains until removed by drainage or evaporation.

In July and August, 1849, cholera was epidemic in this city, and generally prevailed in low and filthy localities. This did not obtain, however, in one instance, as in three blocks, not far from where the Water Works are now located, in the locality known as the "Sands," which was high, sandy, and

[1] At one time it was customary in Chicago to build the smaller houses directly on the ground; but the custom is gradually disappearing, because the death-rate was found to be higher where the tenement was so built than where it was elevated or had a basement.

[2] In the winter of 1870 and 1871 I went to South America at the request of the Orinoco Mining and Exploring Company, to see whether the sanitary condition of a gold-mining district, in Venezuela, south of the Orinoco, could be improved. By carefully weighing and drying the soils I found that they contained even more moisture than is indicated in the text.

[3] From my report on drainage to Chicago Board of Health, 1868.

apparently dry and salubrious, it was very severe and fatal. This locality was inhabited by 322 persons, who were chiefly Norwegians, many of whom had recently arrived.

Nearly all were attacked, and forty-four fell victims to the malady. At the time and for many years after it was queried as to the cause, since the locality was regarded as, comparatively speaking, a healthful one. It was not until 1869 that the chief factor in this high death-rate was discovered by myself. While engaged in examining the borings made in different parts of the city, I found that there was a depression or basin in this locality, in the blue clay, and, as a necessary consequence, the drainage of the neighborhood collected to the depth of two and three feet, while the drainage elsewhere found its way to the lake and the Chicago River. This basin was about seventeen feet from the surface, the overlying strata being composed of loose sand. As these people used lake-water for culinary and domestic purposes, the prevalence of the disease was regarded the more remarkable. No doubt the privies drained into this basin, and the excreta from the first cases was soon carried into it, with the foregoing result. They were living, as it were, above a hidden cesspool. The locality since sewers have been built is one of the healthiest in the city.

In July, 1873, during the prevalence of what was called cholera in the southern portion of this city, I noticed a most marked effect of drainage. The district in which the disease prevailed was densely populated by Germans, Swedes, and Poles, with a level sandy soil, and but little surface drainage. The water was obtained from shallow wells supplied with surface-water ordinarily from five to sixteen feet in depth, and to protect them from caving in, they were lined with plank. A careful inspection of the block in which the first cases occurred, satisfied Dr. Reid, the health officer, and myself, that the water supply had something to do with the malady, being satisfied that the privies and the drainage of a number of cow-stables went into the wells. Steps were immediately taken to supply the locality with lake water, and the wells were all fouled, so that the water could not be used for domestic or culinary purposes. After these precautions had been taken, no new cases occurred for three weeks.

The block fronting on the east side of Butterfield Street, north of Thirty-eighth Street, was perfectly level, and had really no surface drainage; while the block south of Thirty-eighth Street, and on the same side of the street, in population and other conditions was about the same, with the exception of a little better surface drainage, and a ditch of two feet in depth on two sides of it. The number of deaths north of the street, and where the disease first made its appearance, was eleven, and south, only two. I happened to be there on July 5, during a heavy rain-fall, and observed that the surface on the north side was covered with water, while on the south the ditch had carried it nearly all away. To my astonishment in half an hour the water had entirely disappeared on the north side, and the water in the wells had risen nearly two feet, while on the south side but little change had taken place in the depth of the water in the wells.

I had frequently been impressed with our great infantile mortality, but having made a study of this question early in 1873, I came to the conclusion that this mortality was greater in this, than in any other large city in the United States. In judging of this question, it must, however, be borne in mind that we have a younger and more vigorous population than any other city, and that proportionately we have more children and fewer deaths of those over fifty years of age. Since 1856 there were only two years, 1866 (when cholera was epidemic) and 1870, that the number of deaths under five years was greater than all others.[1] This great infantile death-rate is most marked in the undrained districts.

In my report to the Board of Health of this city, in April, 1873, occurs the following: —

"The increase in the number of deaths in 1872 over 1871 was 3,180, a greater change than has occurred in any two years in the history of the city, no matter what the increase of population was, or whether the city was visited by cholera or any other malignant epidemic. This was the more noticeable from the fact that there was not a marked epidemic prevalent, although small-pox and cerebro-spinal meningitis existed in the city, but the number of deaths from these and similar diseases was not great enough to cause this change.

"Attention has already been called to the effect of rain-fall on life, and, after careful investigation, I can come to no other conclusion than that if our system of sewerage had been extended with the same rapidity that it was from 1866 to 1870, this great increase of mortality would not have occurred.

"Prepare tables and group data as we may, the same general facts meet us. This is the more noticeable when it is borne in mind that we know positively how many feet of sewers have been constructed, and how many deaths occurred in each ward, but we do not know with absolute certainty what the population was in each year, as in some years it was only estimated, and in 1872 obtained from the school census. With these uncertainties, and making due allowance for all errors, the result is still the same. For the first period of sewer construction ending in 1860, there were built 2.59 feet to one of the population; the next ending in 1866, there was a falling off to 2.23 feet, and from 1866 to 1870 inclusive, there was an increase to 2.67 feet, and in 1871 a decrease to 2.54, and in 1872 a still greater decrease to 2.43 feet. It will, therefore, be seen that for the last two years the population of the city has been increasing faster than the sewerage has been extended, and that this is the chief cause of the increase in the death-rate. Allowing 1,200 of the deaths for increase of population and the direct result of the fire, 655 that died of small-pox, 425 from crowding and the indirect effects of the fire, we still have an increase of 900, which, I am satisfied, was caused by the want of proper drainage.

"A comparison of the Eighteenth and Fifteenth Wards will demonstrate the truth of the position taken in regard to sewerage. The first mentioned ward has nearly three feet of sewerage to every inhabitant, while the other has but seven-eighths of a foot to each one of the population. What natural

[1] In 1878 the death-rate was lower than ever before, and this decrease is manifest in the fact that there were 1,445 more deaths of those above five years than under.

advantages there are, such as elevation, etc., are in favor of the Fifteenth Ward.

"The number of deaths for July, August, and September, of 1872, were 1 in 104 in the Eighteenth Ward, and 1 in 65 in the Fifteenth; and for the whole year, 1 in 56.70 in the Eighteenth and 1 in 27.02 in the Fifteenth. Of those under 6 years, we find in the Eighteenth Ward 1 in 14.35, while in the Fifteenth there was 1 in 7.81.

"In the Eighteenth Ward there are only 89 square yards to each inhabitant, while in the Fifteenth there are 374; but, taking an extent of territory equal to the area of the Eighteenth, from the lower and eastern portion of the Fifteenth, where the greatest mortality occurs, the difference is not so great, while the air space is still greater than in the Eighteenth Ward. The density of the population in the Eighteenth Ward has been increased since the fire, by the building of a number of houses by the Relief and Aid Society, on lots on Hawthorne Avenue and Elm Street, two and three deep on the same lot, and in a portion of the ward that is undrained. In addition, almost every portion of this ward was burned over, so that the privation, added to the depressing effects of the fire, no doubt had some influence in increasing the death-rate.

"The Eighteenth Ward, as a whole, was naturally lower than any other in the city, until sewers were constructed and the streets improved. These wards are selected for the purpose of comparison, because they are more nearly alike than any two in the city, and lie on the North Branch, directly opposite to each other. Taking all things into consideration, the Eighteenth is the poorest ward in the city. Every portion of the ground is clayey, and was originally low, and its inhabitants are nearly all of the poorer class of our foreign population, of different nationalities, as is also the case in the Fifteenth Ward, with the exception that there are more Irish in the Eighteenth than in the Fifteenth."

The report to the Board had the desired effect, for by reference to the Table on Sewerage (page 11), it will be observed that from 1873 to 1877 there was a large increase in the construction of sewers. Until this period the annual increase of sewerage did not keep pace with the annual increase of population, but during this period it really overtook it, and there was a corresponding decrease in the death-rate, and although in 1875, 1876, and 1877 we had an epidemic of scarlatina, yet the death-rate steadily decreased.

THE PUBLIC PARKS.

It was not until 1866 that the people of Chicago began to take decided steps toward creating public parks on a scale commensurate with the prospective greatness of the city. Several squares and plats of ground had been devoted to the public for breathing purposes in the original plat, when the town was first laid out, and in subsequent additions made to the city.[1] Nothing tangible, however, was really accomplished until in 1869, when, by acts of the legislature, the North, South, and West Chicago Parks were created.

[1] In 1859 I recommended that the Public Cemetery be converted into a public park. This cemetery now forms the greater portion of Lincoln Park.

The two South Parks contain about 900 acres. There are three parks on the West Side — the Douglas, the Central, and the Humboldt Parks — which contain in all 670 acres, and which are connected by boulevards nearly four miles in length. Lincoln Park contains 310 acres, and is located on the Lake Shore, in the north part of the city. All these parks will be connected by wide boulevards, which are already half built, thus encircling the city by a magnificent driveway twenty-four miles long. The parks proper and the boulevards contain nearly 2,500 acres, and when complete will make as beautiful a park system as there is in the world, and one which is the best arranged from a purely sanitary standpoint.

In the year 1868 I had the honor to be requested by the Chicago Academy of Sciences to prepare a paper on this subject. My report made to that body was entitled "Public Parks: their Effects upon the Moral, Physical, and Sanitary Condition of the Inhabitants of large Cities, with special reference to the City of Chicago," and was published the following year.

In this essay, after giving an account of the parks in all the large cities of this country and of Europe, I discussed the physiology of vegetation, and of tree-growth in their relations to climate and health. My main object was to show how by the proper location of parks and improvement, and the planting of trees, the various disadvantages of our location could be overcome by artificial means. It must be borne in mind that, on the South and West Sides especially, these parks were located on marshy grounds, which in the spring were liable to overflow, and in the summer and autumn to give off miasmatic exhalations. The improvement of these grounds necessitated their drainage, which brought the environs of the city under a healthful condition. It also afforded a place of deposit for manure and other offal that could be utilized, thus materially assisting in keeping the city proper in a good sanitary condition. Besides it stimulated and encouraged the improvement and adornment of the adjacent property to a very large extent.

Within the last ten years at least *one million* of trees have been planted in the parks, along the boulevards, on private grounds and the suburbs, within twelve miles of the City Hall.

The experience of the city of Chicago in the matter of these parks has fully verified the predictions made in the paper referred to. I said "that it is not presuming too much to say that the climate of Chicago may be materially modified, and rendered more equable, by the proper location of parks, and the planting of trees, thereby diminishing the mortality of preventable diseases, and improving the general health."

From a careful examination of the meteorological record it will be seen that the drainage of the city, and of the outside lands, and this extensive tree-planting, have already diminished the climatic extremes incident to our peculiar location. It is also quite certain, as the trees become larger and others are planted, these results will be more apparent and more beneficial to the inhabitants.

In the same paper I also said: "We, perhaps more than any other community, need all the possible safeguards against overwork to be thrown around us, and I know of no better way than by the creation of parks, that will be an ornament to the city, and places of resort, where all may enjoy themselves in a rational and healthful manner. We need parks to induce out-door exercise, and for the pleasant influences connected with them, which are so beneficial to our overworked business men, to dyspeptics, to those afflicted with nervous diseases, and particularly to the consumptive."

I introduce these quotations simply to show that sanitary science has made sufficient progress at the present time to admit of the supreme test which science falsely so-called can never endure, — that of verification by subsequent experience; and in this connection I will venture to make one additional quotation from my report to the Chicago Board of Health, on drainage, made in 1869, in which I said: —

"From the results of drainage and other sanitary measures carried on in this city, it may be inferred that the judicious expenditure of money for sanitary purposes is a sound maxim of municipal economy, and from past experience I am satisfied that the mean annual death-rate can be reduced to 17 per 1,000 by continuing in force the present sanitary and drainage regulations, thereby making Chicago one of the healthiest cities in the world."

I have thus briefly called your attention to the natural conditions that obtained here, and also to the artificial means used to improve the same, with the results. It now becomes my pleasant duty to introduce to you my friend, E. S. Chesbrough, Esq., who will describe the sanitary engineering of the city, and to whose skill as an engineer many of the results already spoken of are due.

III.

THE DRAINAGE AND SEWERAGE OF CHICAGO.

A PAPER READ (EXPLANATORY AND DESCRIPTIVE OF MAPS AND DIAGRAMS) AT THE ANNUAL MEETING IN CHICAGO, SEPTEMBER 25, 1877.[1]

By E. S. CHESBROUGH, C. E.,
Engineer of Public Works, Chicago.

PREVIOUS to the year 1833, Chicago was but a trading-post; but the Canal Commissioners had already laid out what is now called the original town. Several localities, at present thickly built upon, could often be visited in wet seasons in boats, which was frequently done to hunt ducks and other game.

Until 1856, the only drainage was that of open ditches along the sides of the streets, except about three miles of wooden sewers or conduits, laid below the level of low water in the lake, and intended more to supply fire-engines than for drainage purposes, though they were used for both. Connections were made with them at the corners of streets for the introduction of suction hose. Gradually substances from the street surfaces found their way into the wooden sewers through the connections, and filled them so much that they became useless, and, on the completion of the water works with fire hydrants, ceased to be of value for fire purposes. For drainage purposes they grew more and more inefficient. Except where the wooden sewers were laid, the only drainage for houses was into open ditches or cesspools, these becoming numerous and offensive in some localities. House drainage into these ditches made them very disagreeable in appearance and odor. Heavy storms, of course, cleansed the ditches, but sometimes caused them to overflow so much as to render the streets in certain localities impassable for pedestrians.

In 1849, 1850, and 1854, the outbreaks of Asiatic cholera were so dreadful as to lead to searching inquiries for means of its future prevention, and of course the condition of the city with regard to drainage received a large share of attention. Provision for an ample water supply was made; but without the proper means of getting rid of water after it has been used, a city is in some respects worse off than before. Many of the lots had shallow, stagnant pools on them part of the year, and most of the cellars, though not deep, were so damp as to be unfit for the storage of valuable articles except coal. Many things left in them would become mouldy in a very short time. The corporate limits of the city included, in 1855, an area of about twenty-five square miles, with a population of nearly 80,000. It

[1] See discussion and further statements in the "Abstract of Proceedings," [A.]

now includes about thirty-five square miles, with a population of more than 400,000. The present limits extend seven miles along the lake shore and an average of five miles from the lake westward. The surface of the ground above the average level of the lake varies from about five to twenty-five feet. Very little of the improved surface of the city is more than sixteen feet above the lake, and most of it was originally less than eight. The ground near the lake shore was higher than that immediately west, leaving a slightly depressed basin drained by the Chicago River and its branches. This basin, though naturally draining into the lake, is divided by a slight elevation, scarcely ten feet above the lake at the greatest depression, from the valley of the Des Plaines River, a tributary of the Mississippi, and only five miles west of the present city limits. The bed of the Desplaines opposite the city is everywhere higher than the lake, and heavy floods in it overflow into the South Branch of the Chicago River, sometimes doing serious damage to buildings and other property. There is abundant proof that at a very recent geological period the lake stood at a considerably higher level than now, and was the source of a large river flowing westward. During the occupation of this territory by the French, and up to the first quarter of this century, Indians and fur-traders frequently passed with their batteaux and canoes from the lake to the Des Plaines River, and in the opposite direction.

The Chicago River and branches, except when affected by rains or changes of level in the surface of the lake, have naturally no current, and consequently could not be relied upon to discharge the sewage of the city steadily into the lake; yet, owing to rains, and to frequent changes in the level of the lake caused by winds, the water of the river seldom remains motionless for any length of time. It was evident, however, from the first, that these would not be sufficient to prevent the sewage of the city, if discharged into the river, from becoming offensive.

In 1855, after the passage of a very wisely framed law, giving the city full power to carry out any sewerage system that might be deemed best, the Board of Sewerage Commissioners, created by that law, organized, offered premiums for the best plans for draining the city, appointed an engineer and other officers, and diligently took such means as seemed most likely to enable them to solve the difficult problem before them.

At that time the Metropolitan Board of Public Works of London was still discussing plans for the purification of the Thames, and the final disposal of sewage was attracting the attention of some of the ablest minds of the world; but no satisfactory conclusion had been arrived at, except that then, as now, all agreed that it should in some way be restored to the land. Then, the only examples of such restoration were those of Edinburgh and Milan, which it would not be practicable to imitate in Chicago, on account of differences of climate and topographical features. At that time the controversy between the advocates of sewers everywhere sufficiently large for men to enter, and those who would use comparatively long lines of small pipes for public sewers, was at its height.

Comparative but not perfect agreement had been attained in reference to the best forms and inclinations to be given to sewers under the various conditions in which they might be needed.

This city was already in possession of water-works capable of being enlarged and extended to meet every requirement, and thus the greatest essential to water carriage in a system of sewerage was provided.

The question which then called forth the greatest anxiety in reference to the plan to be adopted was, whether to resort to pumping up the sewage and discharging it directly into the lake, or to allow it to flow into the river and branches, and thus to find its way through them into the lake. By pumping up the sewage it would have been practicable to give very nearly, if not quite, all the sewers sufficient inclination to make them self-cleansing, to keep the sewage out of the river and branches, and, in the estimation of many, to afford satisfactory drainage not only to existing cellars and basements, but to deeper ones, without raising the grades of most of the streets, as was then strongly advocated by some and as strongly opposed by others. By the latter method a very great saving could be effected in the first cost of the works, and that of their future maintenance would be probably but slightly increased, certainly not sufficient to equal the interest on the difference of cost.

As the advantages and disadvantages of different plans were carefully studied in the light of the information and experience then obtainable from foreign as well as home sources, it was decided, in view of all the circumstances of this city, to adopt a system that would not require the sewage to be pumped up. The strongest objection to this course was the impossibility of giving to the sewers sufficient inclination to make them self-cleansing.

The matter of healthfulness being far above all considerations of economy in the first cost of construction, it was of the utmost importance in seeking the latter not to imperil the former. The actual experience of older cities — especially the European — was carefully studied. It was found that with such inclinations as might be given to the sewers here, without pumping up their contents, all substances properly admissible to them could be taken away by water carriage. Road detritus and other heavy mineral substances would lodge in them and require occasional removal by artificial means; but the cost of such removal was not likely to equal the interest on the excess of cost of sewers that would be entirely self-cleansing. Parent Du Chatelet has observed that when a stream of fresh water, not larger than a town pump would supply, was poured into the old Paris sewers, offensive smells were stopped. It was generally understood, then, that a certain quantity of fresh water added to ordinary sewage would render it innocuous, provided there was a constant flow of both.

The probability of making the river and branches offensive, and ultimately of so filling them up as to destroy navigation, was carefully considered. There could be little doubt that the river would sooner or later become offensive, unless a more frequent change than was natural could be made in its water. To effect such a change, whenever its necessity might become apparent, it was proposed to construct a channel, first between the lake and the South Branch, where the two are only about two thirds of a mile apart, and to drive water through it by machinery. To avoid the necessity for a long time of such an arrangement between the lake and the North Branch, the proposed direction of the sewers was such that very little sewage need be discharged into the North Branch for many years; but whenever such necessity should arise it would be entirely practicable to carry out the plan proposed, with the advantage of all the experience that might be gained in the mean while.

With regard to the injury to navigation by filling up the river with sewage deposits, it was contended that the same floods which from time to time scoured the bed of the river and maintained its depth would continue to do so, as sewage matter likely to be deposited in the river would be no more difficult to remove by floods than the alluvial and other earths brought into the river by its tributaries and deposited in ordinary seasons.

Besides the heavy expense of any system of sewerage that would have kept the sewage out of the river, actual experience in such matters was in 1855 so meagre as to furnish no positive guide to what would be the result of such a system here, especially of intercepting sewers and pumping works. Nothing was done then, or has been done since, to prevent the carrying out of the most efficient system of intercepting sewers that could be devised; but serious doubt as to the extent of districts to be provided for, and of what would ultimately be considered the best disposal of sewage, together with the question of cost, led to the course which was adopted. It was not possible to determine then, if it is now, whether the final solution of the difficult problem of sewage disposal would make it necessary to discharge ours into the lake, or conduct it landwards, and convert it by irrigation or some other process into a fertilizer. It will readily be seen that not only the appropriate outfalls of the sewage by the different schemes would have been widely apart, but the inclination of intercepting sewers leading to them should have been in opposite directions.

In carrying out the system thus adopted here, the circular form of sewers was chosen throughout for the following reasons: —

First, Because for equal capacities of discharging water when half full, or nearly so, they are more efficient than any other form.

Second, For equal strength and capacity, they are more economical to construct.

Third, Where the ground is naturally low, they require, when of equal capacity, less elevation of the surface to protect them from frost, a consideration of great importance in 1855, and still so in large districts of the city.

Fourth, Owing to the impossibility of preventing slight deposits of sand or earthy matters in sewers of such slight inclinations, and to the certainty that the rise of the lake would often cause back-water to fill them half full or more at their lower ends, the theoretical advantages of egg-shaped sewers for discharging small depths of water, would have been very small, if appreciable.

The variations of the surface of the lake caused much investigation relative to the proper levels for the outlets of the sewers. These variations are, first, and by far the most important, the change from extreme average low water to extreme average high water, about four feet, which, so far as is now known, occurs in from three to ten years. The terms "average low" and "average high" water are used to denote a condition of the lake unaffected by winds, which sometimes make a still greater variation of two feet from the average, either raising or depressing the surface to that extent in extreme cases, according to their direction.

Second, and next in importance, the annual variations, which always depress the surface of the lake most in winter and elevate it most in summer, the average difference between them being about eighteen inches.

Third, that caused by the wind, and very rarely lasting more than two days at a time, or equaling, as before mentioned, two feet in extent.

Fourth, there are frequent oscillations which, during their continuance, occur once in about twenty minutes, causing changes in the direction of the current of the river. The rise and fall in the surface of the lake at such times is generally but a few inches, and rarely exceeds a foot. Extraordinary cases, however, sometimes cause much greater variations. About four weeks since "a wave" as it was called, produced such an effect upon the current of the river as to damage shipping. At some pile work on the lake shore at the northern boundary of the city, the greatest variation between the crest and bottom of the wave when it could be observed and measured was nine feet. Oscillations produced by this wave were said to continue upwards of twelve hours.

All of these variations in the surface of the lake would have more or less effect upon the action of the sewers and upon "dryness in cellars." It was evidently useless to encourage owners of property to expect permanent dryness in cellars, the bottoms of which were below high water, by establishing sewers so deep that they could be empty only at low water; besides, sewers so arranged would have had, for months at a time, nearly or quite four feet of water in them, and would have been excessively inconvenient to enter for making connections or any other purpose. The great desirableness, however, of avoiding the expense of raising the streets higher than was otherwise necessary, rendered it inexpedient to place the cellars so high as to be above the effect of the strongest winds during the highest stages of water in the lake. Hence a level of not less than five feet above low water was recommended for the bottoms of cellars. The possibility of preventing cellars from being flooded at extreme high water from winds, or during excessive rains, by means of tide valves, was carefully looked into; but contrivances so seldom needed and so likely to be out of order when required, could not be relied upon; besides, a valve that would act readily and efficiently under a pressure of several feet, twice a day, could not be depended upon to give equal satisfaction under the pressure of a few inches, at long and irregular intervals. The levels of the bottoms of the sewers at their outlets, as adopted, varied from low water to two feet above for the smaller ones.

With regard to the danger of silting or filling up of the sewers, the plan decided upon contained the following precautions:—

First, The establishment of catch-basins at the corners of all the streets, to prevent sand and other heavy substances from entering the sewers.

Second, The provision already mentioned for a constant, though moderate current of water, sufficient to carry off all matters that could be held in suspension.

Third, Man-holes everywhere, near enough together to admit of the sewers being entered for examination or cleansing, and,

Fourth, Provision for flushing out or removing by hand or machinery, deposits that might form.

The sizes of the sewers determined upon, were designed for the out-flow of a rain-fall of one inch per hour. House-drains were to enter the sewers generally not more than six inches above their bottoms, to secure the greatest dryness in cellars at ordinary times.

Pipe sewers, so strongly condemned then for important streets, by the conservative engineers of England, and as strongly advocated by others, were cautiously adopted here for single blocks or squares, including lengths of vitrified twelve-inch pipe, seldom more than six hundred feet. As there were no manufactories at that time of such pipes in the United States, and as it was deemed exceedingly desirable to encourage their establishment, especially in the West, it was determined to make the pipes without sockets, and use rings for the joints, this practice having been resorted to previously in Quebec, under the advice of Mr. George R. Baldwin, who devised and carried out the sewerage system of that city.

For the larger sewers, stone and iron were proposed; but it was found, on careful inquiry, that here as elsewhere generally, brick was preferable, except at dock fronts, or other points exposed to the frost. A very good article of hydraulic cement had already been manufactured in the West and introduced to this market.

Having given the reasons for adopting the plan now described, it remains to be shown what have been the results of actual experience during the last twenty years, as such results in this and other cities are objects of the greatest interest to this association.

With regard to improved healthfulness, it would undoubtedly be better to let the medical profession speak, as they are expected to do. The great preponderance of their opinion, so far as it has been expressed, supports the view that our sewerage system has much improved the sanitary condition of this city. With regard to comfort, including the important items of cleanliness and convenience, there is but one opinion, so that the districts which are still without sewers are using every effort to obtain them, the want of funds alone being the hindrance to their extension wherever needed.

The effect of discharging the contents of the sewers into the river was gradually manifested by increasing its discoloration and offensiveness, and thus affecting the lake so that the water supply to the city was more and more complained of. This proved a matter of such vital importance that it led to the construction of the lake tunnel, by means of which the city was supplied from a point two miles out from the shore with very wholesome and satisfactory water.

The river became more and more foul, until merchants and others were made sick in their offices by exhalations from it, and the community was aroused to the necessity of doing something to purify it. Projects of various kinds were again discussed; such as intercepting sewers, canals between the lake and the river, Artesian wells, immense storage reservoirs in the country and the deepening of the Illinois and Michigan Canal, so as to make it feed constantly from the lake through the main river and South Branch without the intervention of machinery or locks. A commission appointed to examine all the proposed plans, finally recommended that of deepening the Illinois and Michigan Canal, and it was adopted and carried out by the city authorities. Upon its completion in 1871, it at once relieved the main river and the South Branch from their offensiveness, and continued to act very efficiently until the completion of the Ogden and Wentworth Canal. This received so much water from the Des Plaines River as to supply all or nearly all that was needed to feed the Illinois and Michigan Canal, the beneficial effect of which would otherwise have constantly changed the water of the main river and South Branch by drawing its supply from the lake. Happily this state of things has been restored by the erection of a temporary dam to prevent the Desplaines River from discharging into the upper end of the Ogden and Wentworth Canal, so that this summer the main river and South Branch have been free from offensiveness in smell, while in appearance they have been greatly improved.

Almost every year, at the breaking up of winter, there is a very strong current in the Chicago River, far beyond the capacity of the Illinois and Michigan Canal to carry into the Illinois River, and consequently it passes into the lake, extending beyond the entrance to the tunnel that supplies the city with water, which thus becomes affected more or less perceptibly to sight and taste. Last spring this effect continued for nearly a week, and was very strongly marked. To remedy this evil, should it become so great as to demand such a remedy, it is proposed to extend the water-tunnel two miles farther out under the lake, provision for which was made in the structures already completed. At the time the construction of the lake tunnel was determined upon, careful examinations were made and no evidence was obtained that the effect of the river could be perceived more than about a mile and a quarter from the shore; but as the repeated extensions of the piers at the mouth of the river into the lake had been previously followed by the formation of new bars outside, it was feared that ultimately the mouth of the river might be extended much farther out, and thus carry the sewage where the currents of the lake would lead it much nearer the "crib" or entrance to the tunnel.

The results of the sewerage system with regard to difficulties and cost of maintenance is as favorable as was expected. Mr. William H. Clarke, who has had charge of this department for the last sixteen years, reports that there were January 1st of this year 265¾ miles of sewers, of diameters varying from one to six feet. These had cost $4,659,247.56 to build. During the last four years, it cost an average of $32,427 a year for cleansing, not only the sewers themselves, but the catch-basins, a sum which is less considerably than the interest on the extra amount it would have cost to sink the sewers low enough to give them self-cleansing inclinations, irrespective of the cost of intercepting sewers and pumping works, which would have been millions more.

Whatever, then, may be determined upon with regard to the final disposal of the sewage of this city, pecuniarily, nothing has been lost in the construction and maintenance of the works thus far; even assuming that a system of so-called self-cleansing sewers would have cost nothing for flushing or cleansing; and that the average cost of cleansing for the last four years must be the rate for the future. With such street and road surfaces as those of this city, there is no probability that any system of sewers practicable to carry out here would have been entirely self-cleansing. On the other hand it is found that the cost of cleansing the present sewers and catch-basins diminishes as the character and maintenance of the street surfaces improves.

The substance removed from the sewers is offensive only to sight, having a black, tarry appearance. It very seldom has a disagreeable odor, and when spread on the ground loses its black color within forty-eight hours, and cannot then be distinguished from the ordinary surface mould, and it has no more value as a fertilizer. The prejudice against it, however, on account of its unsightly appearance when first taken from the sewers, causes it to be removed to places where it is of value for filling up, or at least, is not considered a nuisance.

Wherever the sewers have been constructed and the streets paved, the old offensive open ditches have disappeared, and the streets during the heaviest rains are as passable as those of the older cities. The cellars and basements, when properly constructed, are dry, and used not only for the storage of valuable goods, but for offices and shops of various kinds.

The cleansing of the North Branch would have been accomplished before this but for the financial condition of the city. For this purpose a conduit twelve feet in diameter, with a bottom nowhere less than thirteen feet below low water, has already been constructed on Fullerton Avenue, the northern boundary of the city. It is believed that the requisite machinery for driving 24,000 cubic feet of water per minute through it will be in operation by the early part of next summer. This machinery is to be capable of causing a current in either direction between the lake and the North Branch, as the season or other circumstances may determine to be best.

The conduit has been so located as to be capable of serving as an outfall into the lake of a system of intercepting sewers, should such a system ever be adopted for this city.

No provision has yet been made for the cleansing of the South Fork of the South Branch — by far the filthiest body of water in or about Chicago. Fortunately, the residents along this channel are but few in number, but its vile odors are sometimes carried by winds into other parts of the city. No plan for the purification of this stream has yet been adopted, though one, at least, has been under consideration for some time, and various preventives have been suggested for this nuisance, which is caused by refuse from slaughter-houses, rendering establishments, manufactories of fertilizers, etc.

The same average depth of the river that existed previous to the construction of the sewers has been maintained since, principally by occasional floods.

It will be seen from the foregoing statements that Chicago is situated differently from the seaboard cities of the East and from the river cities of the West, and in some respects from other lake cities, with regard to sewerage. Eastern cities, by draining into the sea or tidal rivers, are in no danger of affecting their own water supply. Those of the West discharge their drainage into rivers below the points from which they take water. The sites of other lake cities have topographical features much more favorable to rapid and perfect drainage.

The great problem of the future here is that of nearly if not quite every other large city in the world: What is to be the final disposal of the sewage? There is a growing sensitiveness to the possibility that an increase of drainage from the city into the lake will seriously affect the water supply. If, on the other hand, all the sewage of Chicago must pass through the Illinois and Michigan Canal into the Illinois River, unless the canal is enlarged, the South Branch may, before the population of the city reaches one million, become again offensive. To prevent this, and to put Chicago in steamboat communication with St. Louis and New Orleans, it is proposed to widen and still further deepen the canal, which, in connection with the State improvements of the Illinois River, would be one of the greatest works of the nation.

IV.

REPORT ON A SANITARY SURVEY OF THE UNITED STATES.
(*Continued.*)

[SUBMITTED AT THE ANNUAL MEETING, CHICAGO, SEPTEMBER 25, 1877.]

BY DR. E. HARRIS, *Chairman.*

THE schedules which Dr. J. S. Billings submitted to the Association in 1874, and which were reported complete at the annual meeting in Baltimore in 1875, have awaited the development of resources, in the States or under the National Government, which shall be found adapted and adequate to the project, not only of such surveys, but to the practical analysis of their accumulated data.

It must not be supposed that the delays which precede action are to be counted as lost time. The great systematic inquiry and survey will undoubtedly be inaugurated as soon as the nation has a recognized system and central bureau or department for the public care of health. The best organized of the State Boards of Health, if well supported, could soon begin, and, in a year or two, complete the survey and inquiry as devised in the committee's schedules. This work requires both the pecuniary means and the central organization, with a systematic support of such an organization in a State. The National Public Health Service, if ever organized, will almost necessarily depend upon State and Municipal Boards of Health for the mature results of such a general sanitary survey. Not that the nation might not order and provide for the survey, but that the practical purposes of it can be attained only by certain kinds of general interest and actual coöperation in the several States. The proposed survey is a specific kind of preliminary inquiry along the numerous lines of physical facts upon which public health chiefly depends. A portion of the data may be reduced to definite forms as readily as the topographer reduces his field-notes of a survey to charts and maps; while other portions of the returns called for by the schedules would remain as matters for reference.

As the schedules provide for a survey and inquiry quite different from any general survey that has ever been made, and as the schedules and plan are submitted in advance of the organization of any governmental office or system for ordering and guiding the work, it is important that the State Boards of Health should begin to consider the subject, and that the schedules should be printed. This Association has no funds, at present, to warrant the great expense of such printing and wide distribution as we now urge.

Can any State Board undertake this for the public health interests of its own State and the country at large?[1]

It is an important and most significant fact that the leading investigators of the causes of preventable diseases and mortality during the past hundred and fifty years have insisted upon the paramount duty of exact and comprehensive inquiry and registry of the physical conditions upon which the causation of these evils depends. This was the object of Dr. Sutherland's original series of questions, to which Dr. Billings alludes in his report, and the American Medical Association was incited by the same purpose in its endless and too promiscuous contributions on Medical Topography and Hygiene. The State Medical Society of New York began to devise and make this class of contributions as the first and most important service to the medical profession and the State, sixty years ago; and numerous other State Medical Societies and each of the State Boards of Health have evinced the same purpose. The State Medical Society of Massachusetts gave hearty support to the first official sanitary survey of a State, in 1849, — a work that was incited by its own members and the American Medical Association. But few States are likely to imitate the great example of Massachusetts in thus ordering a survey. The special intelligence and the requisite facilities for devising and conducting the work, and for analyzing and making a practical use of the accumulated information, will be found to reside in the State Boards, or must be sought in a National Board of Health.

That certain elements of exact knowledge of the topography, surface geography and geology, and of the waters, the social and industrial conditions in each district, such as every State ought already to have by virtue of its own economic investigations or surveys, will be found wanting when the proposed sanitary survey is begun, will render it expedient for the members of the Public Health Association to look into these matters of general interest in the several States, and to encourage the topographical, hydrological, and other general inquiries which have a basic relation to any comprehensive sanitary survey. The next census in each State, — whether it be by State or National authority, — should have great exactness in regard to population and the housing and industries, the diseases and disabilities of the people. The geological and other physical surveys now in progress, or to be instituted, ought to be influenced in the interests of public sanitation.

Let these two points, — respecting census and State surveys, — be more fully explained by the following illustrations: First, as regards census enumerations, it is important that the whole subject of mortality, disabilities, and the present sickness in every place, be made to contribute exact and very complete records of facts worthy of use in the interests of sanitary science and the care of public health. It is also important that the housing and distribution of the people be recorded properly. It is necessary that the family and industrial conditions be adequately enumerated for the sanitary as well as economical objects of such a consensus. Second, as regards surveys already conducted by the State or the Nation, whether geographical,

[1] The National Board of Health has ordered the Schedules to be printed and issued as Document No. 2. ED.

geological, hydrological, or agricultural, or in regard to forestry, sanitary science and public health interests should file their demands and invoke results which can be insured in such surveys only when the objective points of public hygiene are clearly defined. The definite knowledge of certain great demands of hygiene by Dr. John S. Newbury, the Director of the Ohio Geological Survey, and by Professor Orton, of the same great work and as the head of the State Agricultural College, and the same kind of preparatory knowledge of sanitary questions by Professor Cook, of the Geological Survey of New Jersey, enabled these esteemed directors of State work to contribute directly to the basis upon which the most important sanitary improvements in their respective States must depend. The hydrographic survey of the Mississippi River and its tributaries, the coast survey of the navigable affluents of the Northern Atlantic, — from Maine to Florida, — the resurveying of the public lands and swamp areas, pertaining to National and State domains, with whatever other surveys the government directs, should, from this time forward, be influenced in some worthy manner in the interests of sanitary knowledge and the public health service. This must be the case when to State Boards of Health there is added a National Sanitary Council.

Until each State wins some conquests over the general and specific causes of diseases from its malarial and unhealthful regions, and from the contagions which should be "stamped out," and until this National Union of States shall maintain a Central Sanitary Council, this discussion and voluntary encouragement of a sanitary survey should continue; municipal and other local health authorities are already beginning certain limited surveys, and the State Boards of Health may find a way to make such work universal for their respective States. But were there a National Centre and support for the general survey, then it would become, like the Ordnance Survey of England, by the Royal Topographical Engineers, the source, not only for supply of information needed in every parish, but also be the source of a new inspiration to local improvement and for more careful and minute inquiries; for in that grand survey of England's topography, which was projected upon a scale of mapping one inch to a mile, the people at last became so interested in the practical benefits of the maps and charts that the parishes sought for minute surveys, upon a scale of six inches to a mile, and the Parish Map has become a sanitary and economic institution. The local boards require them.

This report of progress, without action by the committee, is due to the Association which still waits for the movement of National or State authorities to provide for the survey. The committee will be invited to review the whole subject of sanitary surveys. But as regards the preliminary inquiry and survey as contemplated in the schedules, the sooner the work is prosecuted to completion, under a competent national leadership, the better. The organization and immediate utilization of the scheme, the printing and postage, and the official centre for the undertaking, obviously require the intervention of a national office which shall command all these facilities. Yet any State Board of Health could do its own share of the survey separately, if its finances permit. General and specific sanitary improvements have followed each great inquiry, whether municipal, state, or national. The public health improvements in England followed close upon the great "Inquiry into the Health of Towns," and the actual surveys under the General Board of Health, which succeeded that "Inquiry," extended to nearly 240 cities and populous towns. These two general surveys were carried on, in succession, from 1843 to 1855.

The sanitary survey of Massachusetts, under the leadership of Dr. Lemuel Shattuck, in 1849–1850, was hurriedly completed in less than a year, and the plea then made for a State Board of Health was kept up until 1869, when that pioneer of the State Board was organized. The sanitary survey of the city of New York in 1864–1865, was closely followed by the Metropolitan Health Act and Sanitary organization in 1866. So it will be when the proposed National Survey has brought forth its fruit. Though now we wait, earnestly watching the development of adequate central organization and resources, State and National, to make such work successful, the purpose and the outlines now scheduled must not be given up. Practical studies, definite local surveys and plans of improvement, will follow closely upon such a general reconnoisance and registration. There will be thousands of instances in which the local sanitation thus incited will lead to such care of the public health, and such promulgation of the laws of healthy living, that the cost of this preliminary survey will be repaid in every State a thousand fold.

V.

THE SANITARY VALUE OF FORESTS.

A PAPER READ AT THE CHICAGO MEETING, SEPTEMBER, 1877.

By GEORGE L. ANDREW, M. D.,
Of La Porte, Indiana.

MAN is the great disturber in the universe. How he has modified history in the world of morals we are told in Holy Writ. How he has

> "disturbed
> Nature's inmost counsels from their destined aim"

is graven upon the rocks, written upon the sands, and recorded everywhere upon the face of the earth. By neglect or by misuse he has changed a paradise into a desert; by intelligent industry he has reclaimed the sterile waste into an Elysium. Facts which meet us on every hand — in countries the most recently occupied, as well as in those first inhabited by man — furnish many proofs of his ability to waste and destroy as well as to conserve and to improve countries formerly teeming with populations which would now starve upon the same areas. Under the hillocks of sand in the valleys of the Euphrates and the Nile lie temples and palaces, and under the surface of the lifeless desert are buried alike whole cities and the fertile plains which subsisted them.[1]

Denon, the savant, who accompanied Napoleon in his expedition to Egypt, charges the desert to "the decrepitude of the part of the world most anciently inhabited." He says: "May it not have been the abuses of human industry that have reduced it to this state? In this desert there are valleys and petrified wood, consequently there have been rivers and forests; these latter have been destroyed; and from that epoch there has been no more dew, no more mists, no more rain, no more rivers, no more life, no more anything."[2] Speaking of the Desert of Sahara, Champollion, the Egyptologist, thus exclaims: "And so the astounding truth dawns upon us that this desert may once have been a region of groves and fountains, and the abode of happy millions. Is there any crime against nature which draws down a more terrible curse than that of stripping our mother earth of her sylvan covering? The hand of man has produced this desert, and I verily believe every other desert upon the surface of this earth. Earth was Eden once, and our misery is the punishment of our sins against the world

[1] *Eastern Life*, Harriet Martineau.
[2] Denon's *Travels*, London, 1802, vol. i., p. 156.

of plants. The burning sun of the desert is the angel with the flaming sword who stands between us and paradise."

A writer in a recent number of the "Popular Science Monthly" is equally specific, and, if possible, more emphatic. He says: "The physical history of our planet records the steady growth of a desert, which made its first appearance on the dry table-land of Southern Syria, and, gradually spreading eastward down the valley of the Euphrates toward Afghanistan, and westward along both sides of the Mediterranean, now extends from Eastern Persia to the western extremity of Portugal, and sends its harbingers into Southern France and the southeastern provinces of European Russia. Like a virulent cancer, the azoic sand-drifts of the Moab desert have eaten their way into Southern Europe and Northern Africa, and dried up the life-springs of districts which, beyond all dispute, were once the garden regions of the earth." [1]

More soberly stated, but scarcely less explicit, is the declaration of Dr. Hough, Chairman of the U. S. Commission on Forests: "We cannot account," he writes, "for the changes which have occurred since those sunburnt and sterile plains, where the traces of man's first civilization are found, were clothed with a luxuriant vegetation, except by ascribing them to the improvident acts of man in destroying the trees and plants which once clothed the surface and sheltered it from the sun and winds. As this shelter was removed the desert approached, gaining new power as its area increased, until it crept over vast regions once populous and fertile, and left only the ruins of former magnificence." [2]

The substantial accuracy of these enunciations is abundantly proven in the comparison of their former state with the present condition of the regions of the earth the longest inhabited by man. Contemporary history abounds in examples of a similar want of provident forethought in our own time; and it cannot be doubted that there is a wide-spread belief that there is danger of a repetition in the western world of the folly which has so disastrously changed so many portions of the eastern hemisphere. It is well, then, that our National Legislature has created a Commission to investigate the subject of our Forestry, and it would be well that this Association should give such emphasis to efforts made in the direction of judicious forest conservation and tree-planting as a calm and careful investigation will show to be demanded by the varied needs of our race.

But is the fear here alluded to well-founded? Will nations continue to rise, each higher than its predecessor, only that their fall may be the more appalling, and their destruction the more complete? Will some future antiquary dig among the sands of the desert of the Mississippi, or of the Ohio, for the evidences of the dead and buried civilization of the nineteenth century? In a word, is there danger that "this fair and goodly earth" of ours is to be added in the not very distant future to the list of worn-out worlds astronomers tell us of? Or, is there not, rather, in an enlightened Christian civilization, a well-grounded hope that a knowledge of the errors of the past will serve to indicate the remedy for the future?

[1] *Op. cit.* Aug. 1877.

[2] *Trans. Am. Assoc'n Adv. Science*, 1873.

There is an inevitable antagonism — an irrepressible conflict — between the wants of man and the existence of the forest. The necessities of populations have, in all time, required the destruction of forests, and the same necessities will continue to demand that the fertile plains be devoted to cultivation and the hills to pasturage, that men may thus be fed and clothed. In ancient times defective methods of culture, ignorance of physical laws, especially those which relate to the rotation of crops and the renewal of soils, gave over to the desert, by slow but certain process of deterioration, the fertile plains which are regarded by Jew and Gentile alike as the cradle of the race. Many times in recorded history have the pressure of increasing wants and diminished fertility demanded the clearing of new areas of forest for tillage, pasturage, or habitation; but for the possibilities opened up in modern times by improved implements for cultivation of the soil, by an enlightened experience and scientific research, which have shown how fertility may be perpetuated and even the desert may be reclaimed, the question of the continued habitability of our globe would, by this time, have become an unpleasant one.

It is asserted that forests influence public health by their effects upon the atmospheric constituents, water supply, climate, and malaria. These points will be briefly commented upon in the order in which they occur, as far as possible; but, from their intimate connection, they cannot be entirely separated in the discussion.

A reference to some of the familiar facts in animal and vegetable physiology is necessary to a correct understanding of the relations the great divisions of organic life sustain to each other. That they are complementary, each of the other, is shown in the fact that animals exhale carbonic acid which growing plants decompose, storing the carbon in their tissues, where it becomes fixed, and returning the oxygen to the air. By means of respiration, which is an exclusively animal function, oxygen is taken into the body, where, uniting with atoms worn out in the various physical and mental processes it promotes their removal, thus making room for new tissue-substance, fitted for new uses, vivified by the wonderful chemistry of the vegetable world. This molecular metamorphosis, this "renewal of life," is a necessity to animal existence, which ceases only at death. Every living animal is thus constantly exhaling into the atmosphere carbonic acid, which, if in sufficient excess, would put out the life of all animated beings as water puts out flame. The necessity of an abundant and active vegetation for the depuration of the atmosphere from the excess of carbonic acid thus set free becomes apparent when, in connection with this source, we take into account the immense quantities added to the atmosphere by the decomposition of vegetable matter, by the decay of all dead organisms, by the combustion of the various forms of carbon, as wood, peat, oils, coal, etc., for the production of heat and light. What has been done in past eons, in this respect, to fit the earth for human habitation, may be very imperfectly conceived by estimating the amount of carbon stored in the soil as humus, and in the coal fields, — those vast storehouses of the flora of the prehistoric world. So far as known there is no source of free oxygen except the vegetable kingdom. "All flesh is grass." Animals can produce none of the elements necessary for their sustenance, but subsist upon vegetable products elaborated by vegetal forces from inorganic nature. "Hence," according to Professor Gray, "the perfect adaptation of living beings to each other; each removing from the atmosphere what would be noxious to the other; each yielding to the atmosphere what is essential to the continued existence of the other." [1]

The necessity of a preponderance of vegetable over animal life to the health of the latter is beautifully demonstrated in the aquarium. It is there shown that subaqueous vegetation fulfills the same office in preserving the purity of the air in water that land plants do in the atmosphere. It has been found that there can hardly be too large a proportion of plants, as long as they do not decompose, for the health of the animals; but the preponderance of animals over plants invariably disturbs the balance and leads to the destruction of the animals.

The necessity, then, of covering the general face of the earth with vegetation, that animals may not be suffocated with atmosphere surcharged with *carbonic acid*, may be fairly assumed; and one special office of trees in this regard may be the more permanent withdrawal of carbon, retaining it for centuries even, and then returning it to the earth as humus, instead of restoring it to the atmosphere as carbonic acid.

Isolated experiments have been made from time to time, since Schoenbein announced his discovery of *ozone*, upon its influence upon human health, and the laws by which it is governed, but so far as I know it has no practical use in this inquiry.[2]

There are few questions in public hygiene more important than that which relates to the *water supply*. The special need here is: That the water be pure, and that the supply be abundant, constant, and universally distributed.

That forests influence the water supply by condensation of aqueous vapor from the atmosphere and promoting its precipitation in rain and dew, and by storing up the excess of rain-fall, and regulating the supply of streams and springs, may be proved, I think, by a "cloud of witnesses," a few of whom only can be introduced here.

[1] Gray's *Structural and Systematic Botany*, 1876, p. 201.

[2] Recent observations on the allotropic form of oxygen would seem to give a more important place to ozone in its relations to human health than is here indicated. By virtue of its extraordinary affinity for the products of decomposition it undoubtedly purifies the air of localities in which it abounds by destroying noxious gases and by oxidizing decomposing organic substances. It also promotes nutrition and healthy blood-changes by supplying to the respiratory organs a more active form of oxygen than is found in the normal constitution of the atmosphere. The turpentine exhaled from pine and hemlock forests possesses to a greater degree than any other known substances the power of converting the oxygen of the atmosphere into ozone. Next to this are, probably, those essential oils which are most effective as germicides and antiseptics, — *e. g.*, the oils of mustard, bitter almonds, and eucalyptus. Hence, probably, the often undoubted efficacy of residence in high, dry, piney regions in preventing or arresting phthisical development; and hence, too, the supreme importance of preserving such evergreen forests as experience has shown to be especially useful in this regard. — [G. L. A., July, 1879.]

White, of Selborne, in one of his charming letters, thus relates how the trees condensed the moisture in England one hundred years ago: "In heavy fogs, on elevated situations especially, trees are perfect alembics, and no one who has not attended to such matters can imagine how much water one tree will distill in a night's time by condensing the vapor, which trickles down the twigs and branches so as to make the ground below quite in a float. In Newton Lane, in October, 1775, on a misty day, a particular oak in leaf dropped so fast that the cartway stood in puddles and the ruts ran with water, though the ground in general was dusty." [1]

Fantrat, in the forests of Hallette last year, first measured the quantity of rain both above and below the foliage of trees, and endeavored to take account of the evaporation. He found that the soil covered with forests received six tenths of the whole rainfall, the trees having intercepted four tenths. The hygrometric observations showed that there was always in the neighborhood of the forests a greater quantity of vapor than in the neighborhood of large areas of cleared lands. He concluded that "this envelope of moisture is beneficial to the neighboring cultivated lands, as it flows out upon them during the night time, when such lands are cooled by nocturnal radiation, and the radiation is precipitated upon them as dew." [2]

The most recent observations at this point are thus reported by the same observer, in the "Bulletin of the Paris Academy of Sciences," session of August 6, 1877: "If vapors dissolved in the air were apparent like fogs, we should find forests enveloped by a large moist screen, and for pine forests the envelope would be greater than for others. The forest, too, receives more rain than the neighboring land, and the fact is more pronounced in the case of pine forests than in others. Pines retain in their branches more than half the water poured on them, while leafy trees let 58 per cent. go to the ground."

I am indebted to our colleague, Dr. Lyman, for a kindred observation of his own among the mountains of Hawaii. He says: "The forest belt extends from 1,500 or 2,000 feet above the level of the sea to an elevation of 7,000 or 8,000 feet. Above and below these levels the mountains are unwooded. It is a very common thing to see a dense bank of clouds apparently clinging to the forest and breaking off abruptly into clear air above and below the line of trees."

Two points of observation have been established in Prussia, — one over a young forest of *Pinus sylvestris*, some 40 feet high, and the other over a bare sandy plain 300 meters distant from the edge of the wood, and at the same height from the ground. Twelve months' observations showed that, of the total rain-fall within that period, ten per cent. more fell over the trees than over the bare sand 300 meters distant. Experiments of a similar nature over woods of oak and beech gave an excess of five per cent. only in favor of the wooded site. Further, the mean state of the saturation of the air over the wood was ten per cent. higher than of that over the bare expanse of sand; the former holding much more water in suspension than the

[1] *Natural History of Selborne*, Letter 7.

[2] *Annual Record of Science and Industry*, 1876, p. 78.

latter. The ground under the trees retained far more water in suspension than the exposed earth, — the evaporation being only one sixth of that outside their friendly shelter.[1]

The Special Commission of the Royal Academy of Vienna found that there had been a very decided lowering of the mean and low water heights of the rivers Rhine, Elbe, and Danube during the last hundred years; that the diminution of the amount of water in those rivers indicated a decrease in the productive power of the springs, further proof of this being found in the lessening of the water in the brooks, aqueducts, and fountains, and gave the following as the probable cause: "1st. The uprooting of the forests as affecting the yearly amount of precipitation. 2d. The increased evaporation from the surface of the earth thus denuded. 3d. In this change of the surface condition of the earth, the amount of water precipitated, instead of being held in reserve and slowly percolating, rushes suddenly into the streams, and for a short time high water prevails, which is followed by a long period of dryness. The copiousness of the springs and the fullness of the rivers do not entirely represent the amount of the yearly precipitation of water. On the one hand, a portion is given back to the atmosphere by evaporation; and on the other, a portion, determined in amount by the physical conditions of the ground, penetrates into the soil and affords nourishment for the springs. The influence of the woods in both these tendencies cannot be overestimated."[2]

That geographical mystery of the ages, the source of the Nile, is not yet fully solved, but the amazing copiousness of its flood, and the steadiness of the supply, seem fully explained when we read descriptions by recent African explorers of the equitorial forests which give it birth, and from which it draws its supplies. "Into these forests," says Dr. Livingston, "the sun, though vertical, cannot penetrate, except by sending down at midday thin pencils of light into the gloom. The rain-water stands for months in the stagnant pools." Add to this the earthy sponges which exist nowhere else, and the "pitiless rain," of which he had occasion to write so often in his last journal, six inches falling in a single night, and the requirements are all supplied.

Dr. Charles Beke writes from Cairo that there were two and a half millions of trees in cultivation in Egypt in 1860, and that the number had been doubled in 1874. He found trees along the road, and so extensively planted as to give the appearance of a well-wooded country. "Already," he says, "there seems to be a change of climate as a consequence of increased tillage and forest culture: Egypt is in fact losing its proverbially rainless character. Rain has begun to be felt as an annoyance at Alexandria, and is remarkably increasing at Cairo."[3] By still more recent travelers we are informed that the arable area has been increased hundreds of square miles, and the rain-fall has been more than doubled over the greater portion of inhabited Egypt within the life of the present generation. By means of

[1] Biedermann's *Centralblatt.*

[2] *Smithsonian Report*, 1875.

[3] *Smithsonian Report*, 1875.

artesian wells, and planted groves of palms around them, stations have been created in the Sahara for caravans, and there is good reason for the faith that the multiplication and extension of these oases may result in the restoration of its ancient fertility and habitability to Northern Africa.

Of a like nature is the experience of many portions of the American Desert: the testimony of army officers being both frequent and emphatic as to the effects of areas of cultivation and tree-planting in modifying the rain-fall and other climatic conditions. Dr. Letterman, for example, thus reports the experience at Fort Union in New Mexico: "The climate of the country seems to be changing, especially in regard to the increase of rain; and, from the universality of the opinion among those who have resided longest in the Territory, little doubt can be entertained of its correctness. It is probable that this increase may, in a measure, be owing to the greater extent of land brought under cultivation."[1]

How these, as well as many other desert regions, may be reclaimed, is thus described in the report of Clarence King: "Notwithstanding the apparent want of moisture in the soil, it must be the reservoir from which vegetation draws its entire supply. The loose character of the deposits which fill the valleys and form the foot-hills, not only allows a ready passage for the roots to any necessary depth, but, especially through the force of capillary attraction, compels the retention and absorption from beneath of a sufficient amount of water for the temporary extraordinary needs of these perennial species. And this natural resource of the vegetation must be taken into account as greatly favoring the possibility of the successful introduction of orchard, vineyard, or other tree culture in these at present desert territories."[2]

The Smithsonian Institution has issued[3] the "Results of Meteorological Observations made at Marietta, Ohio, between 1826 and 1859 inclusive, by S. P. Hildreth, M. D., together with the results of Observation at the same Place by Mr. Joseph Wood, between 1817 and 1823," being an almost continuous record of temperature and rain-fall for forty-two years. Dr. Hildreth continued his observations until his death in 1863, since which time they have been continued by his son, Dr. George O. Hildreth, to the present date, sixty years in all. Marietta was the first settlement in Ohio, which was celebrated even among the Western States for the grandeur of the forests which covered almost its entire surface. According to the Report of the Statistician of the Department of Agriculture for 1875, the area of forests in that portion of the State is now about thirty-three per cent.; but such forests as remain are greatly influenced in their character as to density by the thinning of the trees and the absence of undergrowth. A letter with which I have been recently favored by Dr. G. O. Hildreth gives in brief all that is necessary in the present inquiry. He writes: "I am unable to perceive any decided diminution of the fall of rain corresponding to the settlement of the country and the removal of forests. The small streams

[1] *Medical Statistics U. S. Army*, vol. ii., p. 221.
[2] *Geological Exploration, 40th Parallel.*
[3] *Smithsonian Contributions to Knowledge*, No. 120.

dry out in the summer more thoroughly, and rise and fall more rapidly from rains at all seasons of the year; but I do not perceive any change in the amount of rain, other than that alternation or variation, from year to year, which seems to occur without law or assignable cause. One effect upon the large streams of water from the removal of trees from their banks has been the washing of the banks, the widening of the streams, and a lessening of the depth of water in the channels, especially in the summer."

I may be pardoned if I here introduce my personal testimony as to the experience of the opposite side of the State of Ohio, embraced in the lower portion of the Miami Valley. The first twenty-three years of my life I was a resident of Hamilton. During that time business, opportunity, and inclination gave me a somewhat intimate acquaintance with the physical peculiarities of the region between Dayton and Cincinnati, including an area of some four hundred square miles. At the date of my earliest recollection, the areas of heavy forest were quite large over a considerable portion of this region, and that of cleared lands small in comparison. A recent visit, after an absence of thirty years, showed some remarkable changes. The greater portion of the forest had disappeared; the occasional clumps of trees that remained were cleared of their undergrowth, partaking much more of the character of the open grove than of the forest of old. Although the season was early spring, the river and creeks were almost at low-water mark; many of the springs, which were formerly perennial, were now dry; and farms which had formerly been by nature well-watered now depend solely during the summer months upon wells and cisterns. As to the effect of this denudation upon the rain-fall in the Miami Valley, I cannot speak from a record, but am able, through the kindness of Dr. C. Falconer, of Hamilton, to give the general impressions of one who has been during the years embraced in these changes an interested, careful, and competent observer. He writes: "I doubt if these causes have affected the hygrometry of our county perceptibly. We have just cut about the best crop of small grain our county has ever produced. Of one steady change depending upon our surface moisture, I have been a practical observer for forty-five years, which has resulted in the constant diminution of malarious diseases. The clearing out of the small streams by the farmers, and the underdraining of their lands to increase their crops, has greatly lessened the importance of malaria as a factor in our diseases and practice — excluding it entirely in many districts."

"Climate, in its modern acceptation, signifies that peculiar state of the atmosphere in regard to heat and moisture which prevails in any given place, together with its meteorological conditions generally in so far as they exert an influence on animal or vegetable life." [1] The fundamental condition and controlling cause of all climatic phenomena is the heat received from the sun. This produces its varied effects by direct terrestrial radiation, and by means of its secondary effects upon vital forces, aeriform fluids, and all mobile forms of matter. Heat increases the capacity of air for water. Thus at 14° Fahrenheit one cubic foot of air is saturated with one grain of water;

[1] *Encyclopedia Britannica*, ninth edition, Art. "Climate."

at 30° with two grains; at 56° with five grains; at 80° with eleven grains; and at 88°, a temperature not uncommon in this latitude, the point of saturation is not reached until fourteen grains of water has been added to each cubic foot of air.[1] The effect produced upon climate, then, by an abundant supply of water to a heated atmosphere becomes quite apparent. The special office of trees in this regard, besides their influence upon terrestrial radiation, which has already been alluded to, is to draw up their needed moisture from lower strata than those accessible to smaller plants. Under ordinary circumstances plants do not absorb either water or vapor from the atmosphere, and it is probable that the entire supply of water is drawn through the roots from the earth. Having performed its office in leaf digestion, the superfluous moisture is evaporated from the leaves. The amount of aqueous vapor thus delivered to the atmosphere by a full-grown tree in full leaf and active growth is enormous. Von Pettenkoffer by careful experiment found the amount of evaporation to be eight and a half times more than the amount of rain-fall upon the same area.[2] This excess must sometimes be pumped up from great depths, and one important office of trees in preventing the excessive dryness of the atmosphere is, even in seasons of extraordinary drought, to maintain that moisture in the atmosphere so necessary to the welfare both of plants and animals. It has been found practically impossible for grasses, cereals, and the smaller forms of vegetation to meet the demands, in this regard, of the occasional seasons of excessive drought which are liable to visit almost any region deprived of its forests. Hence we have in the India of our day frequent droughts, fever, and famine, alternating with swollen streams and their consequent frightful devastations, chiefly caused by the wanton destruction of its trees.

Malaria, as a factor in human disease, has been alluded to and will receive short mention here. That malaria is organic seems to be generally regarded as probable and almost proved. The two essential agencies in the production and decomposition of all organic forms, whether animal or vegetable, are heat and moisture. The combined influence of these is undoubtedly essential to the production and dissemination of malaria. Whether, when all the attainable facts are gathered together and summed up, it shall be found to be a microscopic fungus as believed by Professor Salisbury, or equally minute algæ as now appears to be almost demonstrated by Signor Lanzi of Rome,[3] it is quite certain that many of the conditions of its growth and diffusion are under human control: 1st. It is found most constantly and in greatest concentration in moist localities. The remedy here is thorough drainage and tillage. This seems to be efficacious everywhere. The swamp of Orx, on the Gulf of Gascony, was surrounded with forests of pine, notwithstanding which the adjacent communities suffered severely from fever until the swamp was thoroughly drained, when the insalubrity disappeared. In the valley of the Rhone fevers have perceptibly diminished since considerable clearings have permitted the free access of the

[1] Flammarion, *Atmosphere.*
[2] *Nature*, December 19, 1872, p. 118.
[3] *Medical Times and Gazette*, December 2, 1876.

sun. The jungle fever of India and the coast fever of Africa, the country fever of our Southern States and the ague of the West, have all yielded to the magic influences of sunlight and drainage. 2d. Malaria seems to be arrested in its transmission from the site of its genesis by forests and tree belts, and perhaps in an equal degree by skirts of rapidly-growing annuals. The eucalyptus among trees, and the sunflower among annuals, thus far stand at the head of their respective classes as filters or destroyers of malaria. Nor is this a new thing under the sun. The Romans recognized at an early day the value of rows of trees and masses of forest as a barrier against the diffusion of febriferous poison, and that such defences might never be disturbed, they were placed under the protection of their gods. So many facts have been recorded, and so many more exist in the unrecorded experience of medical observers residing in malarial regions, that this effect may be assumed as proved. Professor Flint says: "Malaria has an attraction for trees and other organic materials. It is found to be perfectly practicable to prevent the access of malaria to dwellings by planting large trees or thick shrubbery in the immediate vicinity between the originating points and the house to be protected." Professor Metcalfe is of the same opinion.[1] "Malaria," he says, "has an affinity for dense foliage, which has the power of accumulating it when lying in the course of winds blowing from malarious localities." Professor Tyndall made an eloquent and quite effective plea for the use of the imagination in scientific inquiry, and in the various discussions as to the essence of malaria much warranted liberty has been taken in this direction. In view of the established facts resulting from the investigation of Darwin and others into the habits of the insectivorous plants, we have reason to expect new light from that source upon the ætiology and prevention of diseases of malarious origin or complication, and of those caused by organic emanations from living plants and animals. Though in the present state of our knowledge I do not hazard the opinion, I may be excused for expressing the hope that the near "future hides in it" a *positive* science of preventive medicine far in advance of our present most sanguine expectations.

The sanitary value of forests, according to our present light, may be thus summed up:—

I. Forests increase the amount of condensation over their own areas, but by reason of the amount intercepted by their leaves and stems the annual rain-fall at the earth's surface is not, perhaps, materially affected by their presence or absence in regions well covered with other vegetation and thoroughly cultivated.

II. By means of their interlaced roots, mosses, lichens, and humus they check the efflux of superfluous rain-fall, thus regulating the water supply in streams and springs, and decreasing the proportion of the annual precipitation that is borne to the sea by the natural drainage of the country.

III. Forests diminish the evaporation from the earth's surface,[2] but this

[1] *Monograph on Malaria*, U. S. Sanitary Commission, 1862.

[2] "The evaporation from a surface of water in the woods was 64 per cent. less than outside the same." Ebermayer, in *Journal of Meteorology*, vol. viii., p. 253.

hygrometric deficiency is much more than compensated by the increased evaporation from their leaves. Forests may thus become beneficial, or otherwise, according to circumstances. The change which tree-planting has already produced upon our western plains is thus far an unmixed good, but, by increasing the humidity of the climate of certain health resorts, valued mainly for their dryness, — as Denver, for example, — extensive tree-planting is not unaccompanied with evil.

IV. Trees modify temperature, — wooded countries being warmer in winter and cooler in summer. This they do by radiation, but, owing to their slow conducting power, the times of their daily maximum and minimum do not occur until some hours after the same phases in the temperature of the air, thus distributing the heat of the day more equally over the twenty-four hours. The special significance of this effect lies in the fact that, as relating to human health, the daily range of the thermometer is of more importance than the mean temperature of whole seasons.[1]

V. Trees radiate and evaporate through a stratum of air equaling in thickness their height, whilst the radiation and evaporation from grasses, plants, and shrubs is confined to a stratum limited to the comparatively lesser planes which they occupy.

VI. From the preceding it may be fairly inferred that they modify climate to the extent of influencing the amount and character of the diseases in their vicinity. In this inquiry residence *in* forests is not considered, universal experience having shown those situations which are permanently shaded to be insalubrious.

VII. Forests and tree belts are of undoubted value in preventing the dissemination of malaria.

VIII. Trees are of positive sanitary value in affording shelter from the excessive heat of the sun, from the violence of winds, and in promoting æsthetic culture.

IX. The importance of devoting to forests all regions unfit for profitable culture, and of protecting them by an enlightened public sentiment, as well as by legal enactment, may be fairly assumed as a sanitary as well as an economical necessity.

X. And finally, — as specially relating to the city whose hospitality we are now enjoying, — the importance of abundant and extensive tree-planting, especially on its western and southwestern exposures, which was so ably urged by our worthy President in 1869, is such as should command the immediate and earnest attention of every one interested in its welfare.

[1] The yearly oscillations of temperature in the woods are 7° (Cent.) less than in the open fields. The yearly maximum of temperature is found to be 5° (Cent.) lower. Likewise the daily oscillations of temperature in summer amount to 6° (Cent.) less than that of the open fields. The temperature of the soil in forest-land was, in summer, 4° (Cent.) less than that of the unwooded soil. Ebermayer's "Physical Influence of the Woods," *Jour. of Met.*, vol. viii., pp. 209, 232.

VI.

PRACTICAL SUGGESTIONS CONCERNING TREE-PLANTING FOR SANITARY EFFECTS.

SUBMITTED AT THE CHICAGO MEETING.

By PROFESSOR WILLIAM H. BREWER,
Of New Haven, Connecticut.

THE value of forests as a source of fuel, timber, and other crude products, has a relation to sanitary matters, but it is indirect. More directly related to the matter is the use of belts of forest, or screens for shelter from winds, for the protection of our domestic animals, our orchards and gardens, and our dwellings. The great value of such belts or screens for these purposes, in all our Northern States, is conceded, the only trouble is that their value is underrated. Now, in connection with their use, I wish to suggest to those physicians and sanitarians who have the opportunity, to make specific observations on the *kind of trees* constituting such screens or shelters (whether this shelter be a mere belt of timber, or a more extensive forest), and to note whether there is any relation between the kind of trees and the health or diseases of the persons living in their shelter. To illustrate: if *Ailanthus* is used because of its ease of propagation, rapidity of growth, and freedom from insects, does it injuriously affect the health of those sheltered by it? Again, the balsamic or other exhalations of many species of trees have a wide repute, in the popular mind, for the alleviation, prevention, or cure of certain diseases, or, at least, that there is a direct and specific relation existing between them, as between *Eucalyptus globulus* and malarial fevers, pine and catarrh, spruce (*Abies*) and fir (*Picea*) and pulmonary diseases. Now, it seems to me very desirable that attention be specifically called to this, and observations recorded, because as yet we have only suggestions and hypotheses on this matter, so far as the trees ordinarily planted in the eastern United States are concerned.

There is another branch of the subject to which my attention has been turned some years, and where careful investigation should be made and put on record. While cities are not "*forests*," and the rearing of ornamental and shade trees not "*forestry*," yet it is the branch of forest-tree culture more intimately and directly related to public health than any other. How do shade-trees in cities and near dwellings influence health and disease? Aside from the æsthetic, and purely as a sanitary question, what are the best species to rear for shade? With the previous generation, elm, Lombardy poplar, and (west of New England) locust were perhaps the most commonly planted. Now, we find in many New England towns, the beautiful maple, with its dense, dark foliage and greater dampness, is rapidly taking the place of the more open and drier elm. Is this a good exchange? In truth, there is a host of questions relating to this subject which need *investigation in many places*, to a few of which I have already given some attention. An ardent lover of trees, a zealous advocate of free tree-planting, now living in the "Elm City" of almost world-wide celebrity, and every year more and more alive to the wonderful beauty of its tree-arched streets, as a member of the Board of Health as well as a citizen, this question is ever present and asking an answer, relating to these beautiful trees and their ample shade, — *Are they wholesome?*

We know that most of those countries of especial fame because of their health-places have been sparsely wooded, — not shaded, — but sunny and dry. Egypt, Assyria, Palestine, Greece, in the Old World, and California in the New, are familiar examples. On the other hand, forests, as a whole, are unhealthy to live in, and, as an extreme case, the Valley of the Amazon, perhaps the most heavily-wooded region on earth save one, is the most sparsely populated region on the globe, except actual desert countries and the Polar regions. Moreover in those parts of the Northern States which were originally the heaviest wooded — from the Atlantic to Lake Michigan — the climate has, as a whole, grown less malarial with the clearing up of the forests. Most sanitarians, in these modern times, are clamoring for more sunshine in our houses and less dampness; *but* how are these conditions compatible with abundant shade-trees in our streets and about our dwellings. I well remember once remarking to a wealthy ranchero of Southern California, with whom I was dining, how beautifully a few semi-tropical trees would shade his house, which stood in the full blaze of the sun, when the lady of the house quickly answered for him, "No; shade is unhealthy. My mother is past ninety years, and she and I wish no wheezing and coughs, and no neuralgia." I once asked another native of that sunny State, as he was sunning himself on the south side of an adobe wall, — a native Indian of uncertain age, but reported to have completed his century some time earlier, as the Padres at the Mission had recorded him as "adult, forty years," when he had been baptized, over seventy years before, — I asked him the secret of his good health and long life: "*Mucho solana*" (much sun, or much sunshine), was the laconic answer. Shade-trees were scarce there.

On the other hand, all of us who live in the older States know of houses and homes appearing most lovely to the passing stranger, embowered in shade, but where robust health is unknown, and where we cannot help but speculate on the question of how much the damp shade has had to do with the ill health of the family.

Thus far the subject of shade-trees in our cities and about our dwellings has been discussed almost entirely from the æsthetic and sentimental sides, and I have failed thus far in getting definite, recorded observations, or even carefully *formed opinions*, on the sanitary questions involved. I therefore ask the members of this Association to give it thought and observation, as I hope to bring it up again at some future meeting.

VII.

ABSTRACT OF A REPORT ON THE SPRING, WELL, AND RIVER WATERS IN THE DEPARTMENT OF THE PLATTE, MADE TO THE MEDICAL DIRECTOR U. S. ARMY, UNDER DATE OF MAY 26, 1876.

SUBMITTED AT THE CHICAGO MEETING.

BY CHARLES SMART, M. D.,

Assistant Surgeon, U. S. Army.

THE following is a brief abstract of a report made by Dr. Charles Smart, U. S. Army, to the Medical Director of the Department of the Platte, upon the water supply of the posts in that department.

The Department of the Platte extends along the line of the Union Pacific Railroad to and including Utah. It contains eighteen military posts, the water supply of each except two, including springs, wells, and rivers, was subjected by Dr. Smart to careful microscopical and chemical examination, and the results are embodied in an elaborate series of tables, giving the result of the examination of twenty-six specimens. The conclusions of Dr. Smart may be summed up as follows: —

The microscopic characters of the sediments vary but little, and the prominence of living vegetation corresponds to the purity of the water. The free ammonia varies from nothing to .98 parts per million, depending on the rainfall immediately previous to collection of sample. The ammonia distilled from the dissolved nitrogenous matter (which from a hygienic point of view is the important item of the analysis) varies from .10 to .86 parts per million. Taking Lodge-Pole Creek .19, Black's Fork .20, and Douglas' Brook .28, as representing the purest of these mountain streams, he concludes that a good drinking water should not contain more than .30 parts per million. This is a very different result from that arrived at by the English sanitary authorities.

Professor Wanklyn states that water containing .05 parts of albuminoid ammonia per million may be regarded as practically pure, but that even this minute quantity should be looked on with suspicion if it exists with a notable taint of free ammonia, — and that under any circumstances .10 is suspicious, and that .15 and over should condemn the water for drinking purposes. The question then arises what is the cause of this large amount of organic matter in our Western streams as compared with those of Great Britain. These streams ought to be pure as they run through no populous district, spring from a cleft in the rocks, are mostly rapid in their course, and are fed by the rain-fall and the melting snows.

In England the soil is fenced in and cultivated to the banks of the streams. The woods are well kept, and the swamps drained. But here there is no cultivation, vegetation dies and decays on the spot where it grows. In the Uintah, where are the sources of the Black's Fork, there are more fallen trees in all stages of decay than living ones. In the tangled willow-growth of the valleys, where the life of to-day rises from the decay of ages, the beaver dams up the streams, and vast masses of water are rendered stagnant to dissolve the dead vegetable tissue, and find their way by slow degrees back into the bed of the running streams. The snow also furnishes a never failing supply of organic matter to the streams fed by it. Five hundred C. C. of water from snow which fell at this post (Fort Bridger), November 17, 1875, yielded .30 parts of free ammonia, and .50 of distilled ammonia, per million. A number of other analyses were made of snow with similar results, giving for one storm as high as .60 parts per million.

Snow-water has long been regarded as unwholesome, although, as Professor Parkes says, this opinion is based on no reliable observations. How is it that the large amount of organic matter in our streams is productive of so little injury to people using their waters? All the samples examined would be condemned by the British authorities, with two exceptions, and these would be considered suspicious. Cases of mountain fever are common here from May on through the summer, and as this corresponds with the period of snow-melting, it is suggested that there may be an important relation between this disease and the organic matter carried down by the snow.[1] We must look to the character of the organic matter for the explanation of its comparative harmlessness. It is mainly of vegetable origin, and instead of .07 being suspicious, and twice as much dangerous, which applies to that of animal origin, .30 is allowable, .40 suspicious, and .50 dangerous, as was found in one instance, namely, in the post of Sidney Barracks.

[1] The connection between the organic matter in the water supply and these fever cases has been demonstrated. See *American Journal of Medical Sciences*, January, 1878, "On Mountain Fever and Malarious Waters."

VIII.

HYGIENE AT AMHERST COLLEGE.

EXPERIENCE OF THE DEPARTMENT OF PHYSICAL EDUCATION AND HYGIENE IN AMHERST COLLEGE FOR THE PAST SIXTEEN YEARS.

A PAPER READ AT THE MEETING IN CHICAGO, SEPTEMBER 26, 1877.

BY PROFESSOR EDWARD HITCHCOCK,
Of Amherst College.

PROBABLY the first idea of the department of physical education and hygiene in Amherst College originated in the mind of the late President Stearns. He realized the fact that the students of our colleges have bodies which need care and culture as well as the intellectual and moral powers, and which need this care at the same time with the higher education. In the year 1856 we are able for the first time to find any expression of his views, when he says: "The breaking down of the health of the students, especially in the spring of the year, which is exceedingly common, involving the necessity of leaving college in many instances, and crippling the energies and destroying the prospects of not a few who remain, is in my opinion wholly unnecessary if proper measures could be taken to prevent it." And in 1859, in his report to the trustees of the college, when he mentions the death of two members of the senior class as probably hastened, if not actually caused, by a neglect of the laws of health, the whole board of trustees were incited to the immediate erection of a building, the nucleus and beginning of the department. This building is called the Barrett Gymnasium, in honor of the late Dr. Benjamin Barrett, of Northampton, Mass., the largest donor to it.

This building is of stone, two-storied, well lighted and ventilated, and warmed in the cold season. The lower story contains dressing-rooms, bowling-alleys, spirometers, lifting and rowing machines, and the apparatus for securing vital statistics. The upper room (50 x 75 feet, of smooth, hard pine floor, with a clear space of 40 x 50 feet), has upon its walls the dumb-bells and wands, and this motto from Professor Owen of the British Museum in London: "Such are the dominating powers with which we, and we alone, are gifted. I say gifted, for the surpassing organization was no work of ours. It is He that hath made us and not we ourselves. This frame is a temporary trust for the uses of which we are responsible to the Maker. Oh, ye who possess it in the supple vigor of lusty youth, think well what it is that He has committed to your keeping. Waste not its energies! dull them not by sloth! spoil them not by pleasures! The supreme work of creation has been accomplished that you might possess a body — the sole erect — of all animal bodies the most free, and for what? — for the service of the soul. Strive to realize the conditions of the possession of this wondrous structure. Think what it may become — the temple of the Holy Spirit! Defile it not. Seek rather to adorn it with all meek and becoming gifts, with that fair furniture, moral and intellectual, which it is your inestimable privilege to acquire through the teachings and examples and ministrations of this seat of sound learning and religious education." At one end of this hall are to be found much of the heavy apparatus, consisting of the horizontal bar, rack bars, vaulting horse, batule board, spool ropes, peg pole, incline board, perpendicular pole, horizontal, vertical, and inclined ladders, swinging and traveling rings, Indian clubs, lifting weights, and a few other kinds. At the other end is a small platform for the leader of the class exercises, and a piano to secure harmony and rhythm during the exercises. Above this platform is a gallery for the spectators to the exercises, of whom there were 3,635 during the year 1876–1877, 842 of them being ladies. The gymnasium is open during all the hours of daylight, and may be used by any member of college at his will, save that he may not interfere with the exercise of a class when occupying the floor. No restraints whatever are put upon the students in using the building or its apparatus, save instructions as to the proper and healthy use of the heavy apparatus, and impressive caution to the freshmen and new-comers, not to use excessively till inured to work and familiarity with the apparatus by a period of training.

In the year 1859 the department of physical education and hygiene was erected in Amherst College. The title of this department was proposed by Dr. Nathan Allen, of Lowell, one of the trustees of the college, one of her graduates, of which he has been an early and long-tried friend, and a most devoted and faithful guardian of the department of which he may well be styled the godfather. The duties of the professor of this department were established by the trustees, upon the suggestions of Dr. Allen, as follows: The duties of this professor shall be: "First. To take charge of the gymnasium and give instruction to the students in gymnastics. Second. To take a general oversight of the health of the students, and to give such instruction on the subject as may be deemed expedient, according to the general plan stated by the president in his report, and under the direction of the faculty, like all the other studies. Third. To teach elocution so far as it is connected with physical training. Fourth. He shall give lectures from time to time upon hygiene, physical culture, and other topics pertaining to the laws of life and health, including some general knowledge of anatomy and physiology. Fifth. The individual appointed to have charge of this department shall be a thoroughly educated physician, and, like other teachers and professors, shall be a member of the college faculty. It is distinctly understood that *the health of the students* shall at all times be an object of his special watch, care, and counsel."

At the same time, the faculty believed that the exercises in the gymnasium should be conducted according to the following ideas: "First. The main object shall not be to secure feats of agility and strength, or even powerful muscle, but to keep in good health the whole body. Second. That all the students shall be required to attend on its exercises for half an hour, designated for the purpose, at least four days in the week. Third. The instructor shall assign to each individual such exercises as may be best adapted to him, taking special care to prevent the ambitious from violent action and all extremes, endeavoring to work the whole body, and not overwork any part of it. Fourth. That while it may not be expedient to mark the gradation of attainment, as in the intellectual branches, yet regularity, attention, and docility should be carefully noted, so as to have their proper weight in the deportment column of the student's general position. Fifth. That some time shall be allowed out of study hours for those volunteer exercises which different men, according to their tastes, may elect for recreation, and particularly that the bowling-alleys be not given up to promiscuous use, but be allotted at regular hours to those who wish to make use of them, — all these volunteer exercises, of whatever kind, to be under the supervision of the gymnasium instructor. Sixth. That the building shall always be closed before dark, that no light shall be used in it, and no smoking or irregularities of any kind shall be allowed in it. Seventh. That the instructor ought to be a member of the faculty, and give in to it his marks and occasional accounts, and receive directions as other officers of the college are accustomed to do."

This department has now been in operation for seventeen years. During nearly the whole of the first year it was under the direction of Dr. John W. Hooker, son of the late Dr. Worthington Hooker, of New Haven, Connecticut, who left on account of poor health and soon died. And for the remaining sixteen years it is interesting to observe, that though it has been experimental in the work of college education, yet it has been carried on so nearly according to the plan and views of its originators, that to a mere looker-on it might seem as if the work of the department began and ended with the daily four class exercises in the gymnasium. And in the same way one might think that a banking business consisted principally in receiving the checks and passing back the circulating medium through the teller's pigeon-hole. Much of educational work and most of so-called teaching is public, and done by classes, in the recitation, lecture room, or the laboratory. But in this department much of the work is done with individuals, and in ways where it is not known or seen by the multitude.

Each of the four classes in college meets the professor for an exercise in the gymnasium of half an hour's length, on four days in the week. In this way the student presents himself for a public visit to the professor, and may always have a private interview either before or after the exercise, if either desire it. The hours for the exercise are mainly at the beginning and close of the day, as both the most valuable time for exercise, and those which best adapt themselves to the college routine. Each class has its own captain and as many other officers as are best adapted to manœuvre and handle the class in its movements. The general method of the conduct of the exercises is military, though considerably modified to be adapted to the peculiar condition of things. The required exercise of each man and class is best known as that of light gymnastics, or those bodily exercises performed by a class with one or two pieces of apparatus in the hands, each movement timed to music, and all simultaneous and uniform. And the only apparatus successfully used at Amherst is the pair of wooden dumb-bells, weighing less than a pound apiece. The students here have universally preferred the bells to the rings and wands, though these have been thoroughly tried. Each class has its own "exercise" or series of bodily movements with the bells, and these are so managed as to give free, lively, graceful, and vigorous work to the whole muscular system during the time of the exercise. In addition to the bell exercise, marching by the file and flank is considerably practiced, and during the cold months running, or "double-quick" movements. This running is encouraged that the student may gain the very valuable assistance that it gives to the "wind" by furnishing warm air to the lungs, and a more rapid relief by sweating, and greater freedom to the body by the lesser amount of clothing required, than if the necessary amount were taken in the cold temperature of out-of-doors. This exercise varies from fifteen to twenty minutes, and with the temperature from 55° to 60° the student almost always finishes with a moist skin. The remainder of the half hour is occupied in voluntary exercise. Some use the heavy apparatus — about one in eight — or take a longer run; others dance, use clubs, sing, pull rope, toss in the blanket, turn somersaults, and occupy themselves in any proper manner to secure exercise, sport, or recreation.

This amount of exercise includes all that is required of the student, and satisfies probably three fourths of the whole number. The use of the bowling alleys is entirely at the option of the student. Some, however, who are not quite normally robust, or who are specially advised to it, frequent the gymnasium for the second half hour in the day, either following special directions, or enjoying themselves as they like. Others, on account of their robust nature, require more muscular work in order to discharge their superfluous energy, just as some people require more food than do others. It might be thought that accidents would happen here frequently, and that there has been such an exemption from everything of this sort seems to be owing to a special Providence. There has never been a serious result from accident since the building was opened and dedicated to the better culture of the body, unless it be to one young man who fell and was kept from gymnasium exercise for three months.

Before this department was established it was thought that requirements of bodily exercise would be irksome to students and difficult to secure. But experience here has shown that the disposition to shirk this branch of college life has not been so marked as in some of the intellectual departments. Some statistics have been gathered to illustrate this point. In 1868–69 attendance on chapel and gymnastic exercises was compared. Nearly 84 per cent. of the class were present at the gymnasium and 80 per cent. at the chapel. Similar observations in 1870 gave 13 per cent. of absences from chapel and 6 per cent. from the gymnasium. During the second week in May, 1872, the same observations gave 5 per cent. in favor of attendance upon gymnastic exercises. It was thought also, *a priori*, that it would be necessary to excuse many from gymnastic exercise. The past year, however, may be taken as a sample for the sixteen years, during which year only one junior and two freshmen (each with a defective arm) have not been required to attend. There has been no instance in the history of the department where the exercises as required have worked the least injury to the student. But, on the other hand, there are scores of men in whom a marked improvement has evidently taken place as a direct result of the required physical training as practiced here.

The military method, though a little used, is not sought after. It seems idle to talk about military rules and life where there is no military authority to carry out the regulations. Were the college a State or government institution, a military department would be in place, and possibly sustained and prospered. But to talk about military rules and methods without the authority of the ball and chain, the guard-house, or power of life and death in the officer, seems worse than idle. College students will generally chafe under that rule which degrades them from the agents of free will and choice to a mere live machine, except when "the country calls."

The definition or perhaps description of hygiene, as understood in this department, is best given in the words of the late Dr. E. A. Parkes: "Taking the word hygiene in its largest sense, it signifies rules for perfect culture of mind and body. It is impossible to dissociate the two. The body is affected by every mental and moral action; the mind is profoundly influenced by bodily conditions. For a perfect system of hygiene we must combine the knowledge of the physician, the schoolmaster, and the priest, and must train the body, the intellect, and the moral soul in a perfect and balanced order. Then if our knowledge were exact and our means of application adequate, we should see the human being in his perfect beauty, as Providence, perhaps, intended him to be; in the harmonious proportions and complete balance of all his parts in which he came out of his Maker's hands, in whose divine image we are told he was in the beginning made."

With this definition for an inspiration, it is one of the duties of the professor in this department to give a course of lectures on health to the freshman class immediately upon its entering. The subject bears more especially upon the health of student life; and not merely to individual sanitary rules, but to the peculiar necessities of care in so closely compact a body of young and growing men in college, and not those conditions peculiar to the body alone, but to those interesting relations and inter-dependence of body upon mind, and *vice versa*. This department also gives instruction in human anatomy and physiology. The cabinets are well supplied with natural and artificial preparations of the human body, which furnish to the student a proper acquaintance with the structure and uses of the organs of the body, such a knowledge as ought to be familiar to every person of so-called liberal culture. The anatomy and physiology which is technical or professional is not offered to the student, but only such knowledge as may be gained by a tolerable acquaintance with the skeleton, the manikin, and most of the enlarged papier-maché models of Auzoux. As a stimulus to study in this direction, two prizes for the best recitations and examination in these sciences are annually given by the Hon. E. H. Sawyer, of Easthampton. A course of lectures, recitations, and laboratory work in comparative vertebrate zoölogy is undertaken by the senior class. This is arranged so as to give the student an enlarged plan of the vertebrate kingdom, rather than the study of species.

The professor in this department is expected to know the physical condition of each student during term-time. This does not mean that he only sees them at the gymnasium exercise, but that he makes himself acquainted with their habits, bodily condition, and whatever in the physical sense may react upon their mental state. This means that he offers suggestions where he may discover deficiency, excess, imprudence, or ignorance of many of the conditions of student hygiene and life. And the regulations of the faculty are such that these suggestions may, if necessary, have the force of a requirement. The visiting of the ill and disabled students requires a share of the time of this professor. For while the diseases of college life are seldom alarming, or very distressing, or numerous, yet for students living in dormitories and boarding-houses, without home comforts and nursing when ill, much care is often necessary to give comfort during and freedom from the disorders which affect young men at the college period of life. It is to be hoped that the next step in physical education here may be to establish a sanitarium or an equivalent to the hospital of an army.

The amount of time lost in sickness by the students is a fact determined by this department. Dr. Jarvis says that the amount of time lost by each laborer in Europe is from nineteen to twenty days each year; and the Massachusetts Board of Health state that in 1872, in this Commonwealth, each productive person lost thirteen days by sickness. A man here is put on the sick-list if he is absent more than two consecutive days from all college exercises. With this as a comparison, between the years of 1861–62 and 1876–77 inclusive, 23.30 per cent. of the college have been entered on the sick list, or every student in college has constructively lost 2.64 days each year by illness; and every sick student has averaged 11.36 days of absence from college duties. During this same period, forty-eight, or three each year on an average, have left college from physical disabilities, although sixteen of these have returned and entered again their own or a succeeding class. The causes which produced these removals were: In seven cases, constitutional debility; in six, typhoid fever; in five, consumptive tendencies; in six, weak or injured eyes; and single cases because of other infirmities. During this period of sixteen years, sixteen students have died while connected with college: ten from typhoid fever or its results, three by violent deaths (all of them during vacation), two by consumption, and one by brain fever.

The fact of the serious influence of typhoid fever upon Amherst College students seems to demand an explanation, or rather some information, such as, perhaps, may be best derived from the report of the Massachusetts registration of births, sickness, and deaths. Taking the classification of Dr. Farr, in which all diseases are grouped under five classes, we find that twenty-eight per cent. of all the deaths in Massachusetts are from the zymotic class, in which typhoid fever is placed. There are 111 different causes of death as recorded by this same report for the Commonwealth, and typhoid fever stands fourth in order as a cause, only consumption, pneumonia, and old age outranking it in the number of its victims. Again, the deaths of males from typhoid fever were 742, while those of females were but 663. Still further, 42 per cent. of the deaths from this same cause was between the ages of 15 and 30 years (Amherst students average 21 years and 2 months). And yet again 44 per cent. of these deaths was during the months of September, October, and November, the best part of the college term time. ' So that with these data of the Commonwealth as a basis of comparison for the working of this fever, and combined with the fact that students are not at home, and are at the "daring and inconsiderate" age, it seems a wonder that there has not been rather more than less of this malady among the students of Amherst College.

In connection with this subject it is instructive to learn that dyspepsia, though formerly prevalent in college, has lost its foothold here of late years. For the past sixteen years it has not once so occurred as to be recognized as a cause of loss of time to any student. Pork, too, is mostly banished as an article of food. The students will not eat it. The maladies which have visited Amherst students for the sixteen years past have been, in the order of their frequency: Colds, including the few of lung fever and influenza, 35 per cent.; physical accidents, 9.47 per cent.; boils, 4.82 per cent.; eyes, 4.58 per cent.; and so on in decreasing ratio of numbers, with febricula, typhoid fever, quinsy, debility, mumps, bilious fever, diphtheria, bilious trouble, stomach irritation, intermittent fever, measles, teeth, and 45 other causes, with 164 cases yielding 12 per cent. of all the cases of sickness.

The months of the year during which college sickness has prevailed have been carefully recorded. The record, however, can be made out only for nine months, as vacations cover so much of the other months that it would not give completed results. April also has always had a short vacation.

In January the per cent. of cases has been	13.8
February	16.6
March	16.4
April (part of the month)	6.3
May	12.8
June	6.3
September	10.3
October	9.7
November	7.7
	99.9

In addition to the items secured upon the maladies of students, Dr. Hasket Derby of Boston is now instituting a series of personal examinations of every student, in order to determine the effect of college life upon nearsightedness. In due time, without doubt, his results will be given to the public. The vital statistics of the students of college have also been secured. These include the age, weight, height, finger-reach (distance between tips of the middle finger of each hand), chest-girth (average between "full" and "repose"), chest-range, arm-girth (biceps), forearm-girth, capacity of lungs, and a simple test of muscular strength. The results are the averages of the data secured from 1,174 students, with 20,458 items of record: —

Age, 21 years, 2 months.

Weight	139.14 pounds,	63.25 kilograms.
Height	5.65 feet,	1.72 meters.
Finger-reach	5.78 feet,	1.76 meters.
Chest-girth	35.78 inches,	0.90 meters.
Chest-range	3.41 inches,	0.08 meters.
Arm-girth	11.62 inches,	0.29 meters.
Forearm-girth	11.05 inches,	0.28 meters.
Lung capacity	249.87 cubic inches,	4.09 liters.
Strength		10.74 times.

Probably the most important feature of this department consists in placing it on the same status with the other departments of the college course. As, however, it is of so different a nature, and unlike the ordinary methods of so-called school culture, it has taken time and experiments to carry the system along to its present condition. In our educational institutions some method is adopted to inform the student — and generally the public too — where his position is in the institution, and how he progresses. In mental growth and culture this can be determined by recitations, examinations, and exhibitions, since the mental powers should grow through the whole range of mental maturity, and the design of intellectual work is to secure the highest development of mind within its normal limits. But the young man who enters college in his twentieth year has approximated to his highest physical growth and powers; and, moreover, the design of the college physical education is not to produce athletes or physiological prodigies, but only to establish health, and well preserve the body up to the normal standard, and promote the harmonious culture of both. Hence "rank" cannot be assigned to a man if he excels his classmate in heavy gymnastics. To encourage this might be injurious. And to discriminate between four fifths of a class as to the best gymnasts with dumb-bells would be next to impossible, as this proportion of a class perform the exercise equally well. And yet to secure a proper attention to obedience of the laws of health, and particularly the taking of sufficient and regular exercise in a proper manner, is what is attempted to be done for the Amherst student. And if he but gives the attention and care to the needs and culture of his body, as required in this way, he receives an increment to his college rank, or standing, which is recorded on the books of the faculty.

In this way the student has a personal incitement to discipline in this department. There is also an inducement to the same thing in another way, and by the means which are always so effectual to the college student — a spirit of class pride and honor. By the generosity of Mr. John H. Washburn, secretary of the Home Insurance Company, New York, a yearly prize of $100 is given to "the class which, during the year, shall most faithfully discharge its duties in the gymnasium, and carry out most fully the instructions of the professor of hygiene." This prize has been awarded for the last four years, and has shown valuable results in "bracing up" the easy, indifferent, want-of-energy element of society, which is not wanting in a college, — the very character needing push, snap, and tone to make it enjoyable of itself and of use to mankind. The following data, gathered at different periods, show the effect of the class prize: In 1868–69 the attendance on gymnastic exercises, including the excused absences, was 88 per cent. of the class. During October, 1870, the ratio of absence to attendance with the same date was 1 : 17.5. And during the summer of 1876–77, the average attendance of the classes, under same conditions, was 93.5 per cent.

A result bearing upon human viability has been secured by the statistics of this department. It is regarded as the established law that the chances of life grow less and less from about the fifteenth to the twenty-third year of human existence, and the rate of decrease is very rapid. But the tables of health as kept at Amherst College show there is an improvement in health from year to year through the course, thus seeming to show an exception to the law: the ages being from nineteen to twenty-three. For, taking the number of sick men in the freshman class as unity, 1.000, we find that the sophomores give but 0.912, the juniors 0.759, and the seniors 0.578, thus showing that sickness is reduced during the college course of a man nearly one half. Or, by another way, the proportion of sick men in the freshman class is — by the hundred — one in 25.7; in the sophomore, one in 24.2; in the junior, one in 23.7; and in the senior, one in 19.2.

It is not possible to make definite statements as to the value of this department, since no numerical records of data were had concerning these matters before its creation. Hence criticisms, adverse or otherwise, must depend on hearsay, opinions, and general impressions. It is a general opinion that the young men do carry themselves in their walk with more erectness and elasticity, not to say grace, than did the former student of college. Soon after the establishment of this department, boarding-house keepers noticed a better appetite on the part of students, and a demand for the more substantial edibles, such as bread and meat. The opinion of the college faculty is most decided that the introduction of the new department has done much to improve the health of the students. Prof. W. S. Tyler, the oldest member of the faculty at Amherst, speaks as follows upon this matter: "If I were asked to specify what I consider to be the most marked characteristic and distinctive excellence of the Amherst gymnastics, I should say that it is the union of recreation and amusement with exercise, of the voluntary and spontaneous with the required and the prescribed; in a word, of play with work. To succeed in doing this would be, of course, according to Dr. Bushnell's well-known distinction in his article on 'Work and Play,' to bring heaven down to earth. And this is just the success which these gymnastics have achieved."

A value of the system as practiced here has been its humanizing or leveling influence. The best scholar in his class may stand shoulder to shoulder in the gymnasium between two very ordinary scholars, and constantly be made to realize that he is not equal to either of them in physical attainments or endurance. And here a man may not choose his comrade on account of his literary or social qualities: one of the things, perhaps, which may help to prepare him for the battle of life and the development of proper sympathies and self-denial. A moral consideration of some significance has presented itself in the college within the past twelve or fifteen years, which is the decrease in the demands for college discipline. This reached its culmination during 1876–77, when not a single student was removed from college for improprieties of conduct. The drinking of intoxicating liquors, and the useless expenditure of money in style and show, which once were decidedly prevalent in college, are less during the few years past. If any of these things are credited to the department under consideration, it is no doubt very much owing to the giving up of many petty rules when so new an element was introduced into the college. And this very relinquishment places the student much more under his own control, government, and self-reliance.

To some people of very quiet and orderly habits of life, the exercises as allowed here may seem too boisterous and rough a use of muscles, nerves, and lungs. But at the age of buoyancy, exhilaration, and "a superfluity of naughtiness," why not allow the natural disposition to have its proper freedom? Why not give the young man, in the fullest development of his growth, appetite, and desire, a chance to eliminate his extra nerve force with his class companions and in presence of spectators, fair and otherwise, in broad daylight, rather than to furnish him an opportunity to spend the same strength in college pranks and nonsense which he might seek the cover of night to protect him in, and thus make himself a nuisance, if not a law-breaker? When the student has all day been closely occupied with the active use of his brain, and giving the body but a little show of use, why should he not be encouraged to give the muscles, skin, and vital organs a chance to have a most thorough waking and shaking up? Why not let the abandon of his nature have an opportunity to get out of its confinement and thus relieve nature of a heavy load?

Amherst College was brought into existence more than fifty years ago by men and women who realized that there was need of a higher Christian culture in our country and the world. It has ever been in the hands of those who were imbued with this spirit, and the inaugural address of its newly-elected president leads no one to fear that Ichabod is written upon it. And while those who placed its foundation granite were inspired chiefly by the sense of the need of the spiritual and divine element in man's nature, is it not fair to believe that they thus better prepared the way for a true education of soul, mind, and body? As the sound religious idea has ever permeated the institution, the way has thus been better prepared for the philosophical, intellectual, and scientific culture which we are proud to believe has been augmented and superadded during the valuable lives of many of its honored presidents and professors.

And now may we not rejoice that here the physical man is so well considered in his education? Is it not an evidence of more complete culture that the college attempts to educate all the powers of man in his full development? Let the college rejoice, if, in its work for the ages, it shall properly regard the whole nature of man in her training, and do her best in the harmonious development of his powers as God ordained it should be.

NOTE. — The item "strength," on page 53, is peculiar to Amherst College. It has reference to the number of times the student can draw his chin up to his hands while hanging suspended by a ladder-round.

IX.

HYGIENE AND HIGHER EDUCATION.

A DISCOURSE BEFORE THE AMERICAN PUBLIC HEALTH ASSOCIATION AT CHICAGO, SEPTEMBER 25, 1877.

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LAST year I had the privilege of presenting before another national society some views upon the hygienic conditions of the common or lower schools of this country, in which I argued against the confinement of children in the school-houses six hours a day, as unnecessary to their education, and as severely injurious to their health and growth, and I urged the *three hours a day* of schooling, as justified by experience, consistent with the best philosophy, and demanded alike by the health of the children and the best interests of the schools themselves. I repeat only to reënforce those important truths, which, I trust, are destined to an early triumph.

To-night I am permitted, in this fit presence, to pronounce some views connected with the hygiene of our higher schools of learning. The importance of this discussion may be inferred from both the members and the character of the classes concerned.

There are now in operation in the United States about 375 chartered colleges and universities, — the two names being used with much confusion. Reckoning 100 students on the average to each (a number probably below the truth), we have a total of 36,000 college students, or nearly one to each 1,000 of inhabitants, a number which, great as it is, falls far short of the country's needs, to fill with educated men its higher callings and professions. If to these 36,000 college students we add the students of our various professional schools, our numerous high schools, academies, and seminaries, the number cannot fall short of 250,000, — a quarter of a million of young men and women now under training in advanced learning. It is quite possible that a strict count would double this number. The school population of this country, that is, the persons between six and twenty-one years of age whom we usually enumerate in the "school census," amounts almost invariably to one third of the entire population. Out of 45,000,000 (Professor Walker's estimate of population in 1877 is 46,600,000), those counted as of school ages number 15,000,000. Half a million of these would be no extravagant number to be found engaged in higher studies, or even in college courses.

But there is a still more interesting aspect to this question. These thousands of college students are the élite of our youth, — the picked men and women whose superior intellectual endowments and force of character make them doubly precious to the nation. On their life, health, and success, the civilization and future progress of the republic depend in no ordinary degree. An inquiry into the healthfulness of the institutions in which their education is to go on is certainly not one of the least interesting of the questions which concern public health. To save these youth from preventible disease, and from premature decay and death, is to obviate or lessen public loss, and prolong the benefits of our best and dearest education.

VALUES OF MEN.

Let us look at this matter from the bottom up. The costliest product of human skill is a full-grown man. The costliest thing in man is mind. To obtain this full-grown man has cost twenty-one years of care and feeding, — of clothing, sheltering, and governing. All the machinery of society has been run in the interest of these growing men. The primary use of the world's industries is this growing and preserving of men. When a house burns, or a ship sinks, we count the cost, and lament the loss of so much of hard-earned wealth. But when a man dies, few think of the amount of solid value which has disappeared. No owner survives to bewail his loss. The man owned himself, and owner and property disappeared together. The moral and humane feelings of his fellows, properly enough, shut out the merely pecuniary and commercial. The widow and orphan sometimes secretly lament the destruction of the valuable source of their living, but society takes little note that a portion of public wealth has ceased to exist. The loss, however, is none the less certain.

If the man who dies is an educated man, how much more the loss. His education has cost the labor of generations in the creation of the sciences he studied, and in shaping the culture he obtained. And these youth whose manhood and womanhood are but just begun, the expense of whose rearing and training has been nearly met, and whose usefulness lies all before them, how serious a loss is their death.

This estimate of man as a commercial value is not usual, but it is not false. We do not stop with this view. We only begin with it. If we would save a man because of the money that is in him, much more because of the manhood that is in him. Life itself has its values, not to be counted in money. The moral forces, the social ties, the family affections, and all the various relations of the soul to mankind, to truth, to science, to citizenship here and hereafter, to God and immortality, all these give to human life a sacredness which makes its salvation from disabling disease and untimely death a first duty of society. We justly place homicide at the head of capital crimes. Parity of reasoning should place the guardianship of public health among the first of social duties. And to none is it due more than to the young, who stand ignorant and unprotected among the dangers which our civilization itself, in many cases, helps to increase.

And, finally, since the whole argument for public education rests upon the value of educated men to the state, to its industries, to its social and political life, to its very existence and power as a state, the preservation of the educated man in full health and vigor is an important measure of public economy.

But the argument does not end here. The educated man ripens with years. His habits of study are carried from the college into active life. His power of acquisition continues and grows. He adds to the elements of learning the larger results of reflection and experience. Life, like the river, grows broader and deeper with its onward flow, till the old man, full of years, if still sound in health and in natural forces unabated, becomes a pillar of strength to society and state.

What would not republican France have given to have retained for even a few months longer her great leader, Thiers? And what could compensate Germany if her great statesman, Bismarck, were to be taken away? A few words of Agassiz's age were worth volumes of his youth. The world admires young men, but when grave problems demand the service of the best and ripest thought it turns instinctively to the Nestors whose wisdom has ripened through the lapse of years. And to have strong old men we must save youth from the violations of the laws of health. When we construct our 1,000 horse-power engines we must give the supporting parts strength to bear the shock. A Websterian brain in an enfeebled body would be like an ocean steamer's engine in the loft of a rickety barn. Its downfall would be as certain as terrible.

DANGERS TO HEALTH IN COLLEGES AND HIGH SCHOOLS.

It is not wise to exaggerate. There is not probably more sickness to-day among college students than among an equal number of youth of the same ages taken from society at large. And the death-rate in colleges is not greater than in communities outside. We may thank the friends of sanitary reform, perhaps, for the changes which have made our schools and colleges less dangerous to physical health. But it is not to be denied that there are dangers to health peculiar to colleges and high schools, and duty demands that these shall be minded, and mastered if possible. School-life itself is unnatural. Its confinements are liable to be excessive, and it usually involves a sudden change of habits, if not also of climate, food, and water. But most of these are met also by young men going to business, and are not, therefore, peculiar to students of colleges.

To begin our enumeration I wish to affirm, at the outset, that study itself is not one of the dangers to be guarded against.

HARD STUDY IS NOT UNHEALTHFUL.

The exercise of the brain, under the proper conditions, is no more unhealthful than the exercise of the arm, or of any other part of the body. It was made for use. Its functions are as essential to life and health as those of the stomach or lungs, and its full and powerful development is essential to the highest health and perfection of the bodily powers. Like all other parts of the body the brain is subject to waste, and demands nourishment, more in proportion to its size than any other organ of the body. The fresh air, general exercise, and proper alternations of repose required for the health of all other parts of the physical system are also requisite for a healthy brain, and these being withheld will kill a student as quick as another man, but no quicker. That many students lose health is owing not to hard study, but to close confinement without fresh air, and to insufficient general exercise. Intellectual efforts ought to promote health, and doubtless do when the other functions of the body are not sacrificed for it. We are not so badly constructed that, in order to be fat, we must consent to be fools, nor is a dyspeptic stomach the necessary companion of a wise head.

Only the best and the worst students usually show injury. The best because of over-work and under-rest, bad air, and inaction; the worst because of idleness and dissipation. Students between the two classes usually escape injury, except as they approach either one or the other of the classes named.

Omitting consideration of all danger to health coming from sedentary life in general, we may confine our attention to those that are peculiar to student life. And the first of these I wish to note is the over-stimulation of the brain and nervous system, which almost necessarily arises under the school management of this country.

A system of prizes for the largest amount of acquisition, — the so-called best scholarship, — which consists usually in the ability to repeat most of the authors studied, almost necessarily throws the student into long-continued and violent exertions of the brain, often intensified during the few days or weeks which precede a public examination.

THE MARKING SYSTEM.

The marking system in our colleges, while it has certain advantages which professors are quite ready to perceive and use, is fraught with so many dangers and positive evils that it can scarcely be defended. It exerts its stimulating power chiefly upon that small number of students who already are disposed to overaction, while it leaves almost untouched the greater number, who have either no desire, or fancy they have no chance, to attain high rank as scholars. As a sanitary measure, at least, it ought to be abandoned, whatever may be its supposed advantages in securing study and promoting scholarship.

Certainly those in charge of our colleges ought to be able to find a stimulus, if one is needed, to secure the regular application of students to their work, without resorting to this, so productive of rivalries and jealousies; and, above all, so destructive to the lives and health of the best and most promising of our students.

COLLEGE HONORS.

The system of college honors, which usually stands connected with and crowns the system of marking, is another of those bad and dangerous usages to which we expose college life. It is claimed that the valedictorians of college classes rarely respond, in later life, to the expectations formed of them from their success in study; and it may be justly suspected that the unnatural and dangerous efforts required of them to win their position break down the very powers which it was sought to cultivate.

SCHOOL EXHIBITIONS.

It is questionable whether the public exercises with which the school year of our public high schools is usually closed have not the same bad effects. At a time when they are exhausted with their long terms of study, the graduating classes are put under the spur of an ambition to win public applause on the commencement rostrum, and the already wearied brain is urged to renew its efforts, amidst a feverish excitement, to outdo its fellows in a production whose brilliancy is often contrasted with the faded cheek and the dull eye, the weak muscle, and the enfeebled physique which it has ruinously taxed.

All who are familiar with our institutions of learning have had occasion to remark the languid look and the evidently jaded condition with which both teachers and students come forth from their year of effort. No good physiologist or student of hygiene would admit that this is a necessary condition of affairs. It evidences serious violations of the laws of health at some point in the work. And worst of all, the stimulation of which I have spoken is as unfriendly to sound scholarship and real intellectual power as it is to good health. Or rather, because it is unfriendly to good health, it is necessarily subversive of all the aims of study.

THE NEGLECT TO TEACH HYGIENE.

The student, as we have seen, is exposed to all the dangers to health which come to any other person changing from active employment and entering a sedentary life. They are also exposed to others, peculiar to their position as students, and which none can save them from so effectually as themselves. But to save themselves they need to be warned, not only of the immediate dangers which come from change of place, diet, and habits, but also of all the exaggerations of these which grow out of their student life. Their education occurs at an age when their whole system is passing through one of the great critical periods of life, — the period of adolescence, — and when the nervous energies especially are subject to sudden shocks, or weakening changes, which they are little likely to understand, and against which nothing but experience can guard them. This is especially true of female students. Instructions in physiology, and especially in hygiene, ought evidently, then, to constitute not only a part of the general education, but a part of that instruction which should be given to every student at the outset of his career, and to be impressed upon him by frequent repetition. The study of physiology, indeed, demands a place in our entire system of education, from the primary school up, which has never yet been yielded to it. We study geography, *ad infinitum*, learning the location of most unimportant places, and mastering, with the outlay of years, an immense number of meaningless facts which are lost almost as soon as learned. But the equally interesting and far more important facts of the location of the organs of our own body and the functions of these organs are crowded into some small term of study, or neglected altogether. Public health can only come with public intelligence, and especially that intelligence which enables a man to understand and obey the laws of health, which environ and control him in every hour of his existence.

But in our colleges and high schools the study should be far more minute and practical, and the students should be taught and accustomed to apply this knowledge to the solution of every question of hygiene which arises in their own daily experiences and the experience of those around them. The functions of stomach and brain, and their intimate relations, as well as the practical rules by which the brain can be made to do its best work, should be taught as thoroughly as we teach the construction of language or the applications of mathematics.

The members of this association will have accomplished no small good for their country if they can efficiently urge upon every high school and college faculty in the land the establishment, if not of a chair of hygiene, yet of a course of instruction which shall leave no student ignorant in regard to himself, or unable to wisely observe the laws of health.

Hygienic instruction will not only save the health and life of students, but give benefactors to society. Our graduates would constitute an unorganized but most efficient general board of health. The great sanitary questions which concern every community would find those who were able to meet and solve them, and the work of this Public Health Association would find thousands to diffuse its benefits and to aid its researches.

COLLEGE VICES.

There is yet another class of dangers to our college students which must be considered in any complete view of the case. They are those vices which, while not peculiar to college life, are especially dangerous to students, as to all brain workers. Among these vices we may take notice especially of late hours, with their revelings; of gaming, whether for money or for sport; and of smoking and drinking. The first of these results naturally from the collection of large bodies of youth in convenient proximity, and in the possession of rooms of their own, in which they may gather without the usual family control. The very excitement to which the brain has been subjected through the day, by its regular studies, often leaves it full of that feverish excitability which seems to fit it best for the brilliant jest and repartee, the hilarity and the fun, of the social gathering. Crowded into some close room, with closed doors for the sake of secrecy, the intoxication of society is felt to its utmost, and all discretion is too often abandoned as jest and song fill up the hours. No practice could be more ruinous to both brain and body, and no student should be allowed to indulge in such practices without serious and repeated warning of the dangers that he incurs. A single lesson upon the anatomy and functions of his brain and nervous system would warn any one who ignorantly sins in this way, against his own best interests and his own high aims.

Games of chance, which may sometimes furnish innocent amusement, if not healthful mental exercise, to other men, become to the student sources of danger, simply because they serve to still further exhaust the brain, which has already done enough of work. Many a college graduate, in looking back upon his college life, can see that he sacrificed much of the education he might have gained by over-taxing his mind with long and difficult games of chess.

The use of tobacco is becoming so enormous in its extent that it seems idle to attempt to call in question its healthfulness; and while it is used by men of all classes and in all places, from the president's mansion to the lowest saloon, we can hope to make little progress against its use by students. But I imagine that every intelligent physician in the land would concur in the assertion that its narcotic effects must be doubly dangerous to those whose very business demands a constant and large excitement and use of the nervous and cerebral energies; and the smoking among students, avoiding as it does the eye of teachers, is made doubly dangerous by being practiced in close rooms, and often in crowded companies.

I can only hope, for one, that the progress of hygienic science will at some early day demonstrate beyond all doubt or controversy, which is now so firmly believed by many, that the use of tobacco is and must be necessarily, always and everywhere, and in all forms, injurious to health, except where its medicinal influences are required by morbid conditions of the body.

The drinking of alcoholic and intoxicating drinks is not, I believe, a very common vice in our best colleges, unless it may be in those which, following the bad example of the German universities, have openly relinquished their responsibility for the morals and character of their students. In the colleges of the West, at least, the steady influence of faculties and of the better class of students has succeeded in keeping the practice of drinking in such bad odor — under such a ban of public reprobation — that drunkenness is not common. But experience proves that the use of stimulants is a vice to which humanity is so prone, that, hydra-like, it is ready to raise its head and renew its deadly war whenever the repressive efforts are in the least abated. Among a certain number of students it is further promoted by a bad belief that the stimulation of certain alcoholic drinks adds power to the brain, and may therefore be made a means of intellectual success.

To these false and dangerous views of the benefits of alcoholic drinks, let us oppose the testimony of such men as M. Charles Richet, from whose brilliant and profound article, "Sur les Poisons de l'Intelligence," in one of the February numbers of the "Revue des Deux Mondes," I quote the following. After a masterly analysis of the differing effects of alcohol in its different forms and on different temperaments, the writer says: "From all that precedes, we conclude that alcohol in feeble doses over-excites certain intellectual faculties, the imagination, the memory, and the association of ideas; but that it paralyzes others, especially the will, the reflection, and the judgment. With a stronger dose, all trace of intelligence disappears: to the exaltation a profound depression succeeds, — a true coma. The insensibility is complete. No external excitement can awaken the unhappy victim, who is dead drunk." Again he says: "The action of alcohol is not alone the rapid intoxication. It may, if one prolongs the use or the abuse of it, become a chronic intoxication, which disturbs profoundly all the functions of our organs, and finishes by altering the tissues. More, perhaps, than the other organic systems, the nervous system is changed by it, and particularly the brain. Some exact experiments tried upon some animals, whose food was mixed with alcohol, have demonstrated that the brain absorbs a certain portion of this substance, by reason of the elective affinity which certain tissues have for certain determinate poisons, so that one may, after having killed some dogs thus intoxicated, recover from their brain by distillation a certain quantity of alcohol." I should be glad to cite more fully the terrible testimony which this French savant gives to the sad and destructive effects of strong drink. It is not the testimony of a temperance lecture, but that of science itself, — not to be resisted or neglected.

Pausing here in the discussion, let me turn again, in conclusion, to those motives which urge upon your riper consideration the topic itself which I have tried to present.

Ought sanitary science to rest content in simply holding physical childhood unharmed, while mental childhood is getting its schooling? Shall not our schools themselves become sanitary agencies, and, instead of being the burdensome objects of your care, become important coadjutors in your work, helping to spread abroad among the people the facts and truths you so patiently and laboriously collect? Whatever we would have appear in the nation's life, says one, put it in the schools of the people. Thus a double argument comes to us to promote the sanitary condition of our educational institutions: first, to save them, and second, through them to save society itself.

X.

THE REMOVAL AND UTILIZATION OF DOMESTIC EXCRETA.

A PAPER READ AT THE CHICAGO MEETING.

By AZEL AMES, M. D.,
Of Wakefield, Mass.

THERE are a few points upon which all who have given attention to the disposal of domestic excreta seem to agree. To promote the greatest degree of health, comfort, and convenience, all conclude that their removal in the fresh state from the vicinity of man's abode is essential.

All are agreed upon the necessity of, in some way, depriving them at once of their capacity for offense and injury, while all most readily admit the desirability of accomplishing these results at the minimum of expense.

All are further agreed that these excreta possess, in different degrees, real value as fertilizers, and hold certain definite and original relations to the soil, and vegetable life, which render it imperative that they shall be returned thereto.

Of these points of general assent it seems then proper to form a standard or criterion by which all agencies for the removal and utilization of human excreta should be judged, that being held the best which most completely recognizes and conforms to these determinations, all others taking rank in the order of their approach thereto. There is, moreover, no lack of statistical and collateral evidence proving that an inexorable law, holding these requirements, exists and asserts itself, independent of mere human recognition, as a part of the great codex governing the universe.

Such a standard, high and ideal though it seems (in the view of the existing order of things), is nevertheless demanded, is attainable, and is to be earnestly sought.

The problem becomes then, How can the waste of our human economy be most speedily removed, with least offense and least expense, to a permanent condition of incapacity for harm, and in such removal be devoted to the largest utility? It is a question which I do not believe we can wisely call for the division of, and I cannot withhold the expression of my belief that it *is its division* which is responsible, in good measure, for the comparatively unsatisfactory status of removal and conservation to-day.

Systems have been devised which secured rapid removal, but did not avoid expense or offense, *e. g.*, the early efforts of Liernur.

Others are offered which provide for regular removal, and even efficient disinfection and deodorization, but are neither convenient, cleanly, nor cheap, *e. g.*, the Rochdale, Goux, or Thudicum systems.

While still others, *e. g.*, the earth system of Moule, while recognizing the needs of inoffensiveness, cleanliness, and ultimate utilization, has limited availability, involved certain conditions in absoluteness, easily disarranged, and covers the ground rather as an expedient than comprehensively.

Nearly all have left as the last item for consideration, the irrepressible element, utilization, which, though often thrust aside, reappears like the blood on the hand of Lady Macbeth, and will not "out."

From a review of the history of sanitary efforts in Europe, as well as in this country, the conclusion seems warrantable, if not inevitable, that a chief mistake made in the consideration of the disposal of excreta has been in attempting to separate the removal from its *alter ego*, the utilization of the material. As an illustration, Great Britain now expends not far from £30,000,000 sterling per annum for food and guano, and but a few years since opened at her cannon's mouth the ports of nations which, without foreign commerce, had, by careful utilization, supported for centuries populations many times as dense as hers, that by her opium traffic with them she might obtain revenues for her foreign purchases. Yet when her great city of London builds her intercepting sewers and wonderful Thames' embankment at gigantic cost, she yearly runs off, to the pollution of her beautiful river, the germination of disease, and the injury of navigation, that which, applied to her soil, would, by computation, produce more than her annual expenditure for food and fertilizers. Nor do her exhibitions of engineering skill indicate that such application to the soil is impossible or even seriously difficult. On such a statement the thoughts naturally occur: Has this never been considered or tried? Have not all systems of utilization been widely discussed and even experimented upon with as much honesty of desire as ours to discover means to so desirable ends? To which there appears, with others, one answer, almost generally applicable as true, namely, it has not been necessary to consider utilization in the beginning, but as a possible end. It is not that the problem has been unattempted, but that it has been held of secondary import in nearly all cases, has not been kept constantly and equally in view as of parallel importance from the outset, nor as an inseparable component of an organic whole; a whole as imperative and as ultimately exacting in its relations to sanitary and economic problems as any can be. A part of a grand conspectus which will not be left out without final disarrangement and damage to the entire programme. Hourly the conviction deepens that these twin components of our chief sanitary problem will not be divorced, and each year's added experience brings assurance that under no system of control that can obtain approval will it be found necessary to consider them apart.

Utilization having been, like the sections of the unplanned sewerage of small towns, *patched on*, not considered from the outset with reference to the whole, the result has been that it has proved the interest to suffer and give way when details conflicted, the expense mounted up, or a choice was to be made between routes or plans. Its present necessity has not been imperative, and its future demands have been generally ignored. Engineers, accustomed to old and familiar methods, have not been friendly to the ingrafting of utilization thereon; while, especially through the western and southern sections, the native fertility of the soil has so waived the use of fertilizers that, not until the rapid drains of heavy crops have driven the wheat section in twenty years from the Genesee Valley of the Empire State to the new lands of Wisconsin and Minnesota, and have sent the Southern planter to the Chincha Islands and Peru for guano, nearly exhausting their supply, have we realized that at a rate eight and one half times as rapid as that of Great Britain, and thirteen times as rapid as that of Belgium, we are arriving at a cost of living that is not only oppressive in itself, but brings its train of attendant social and sanitary ills. That we must speedily conserve all the forces that stimulate supply is the one point emphatically taught.

REMOVAL.

The questions to be asked concerning a method of removal and conservation of excreta, to determine its conformity to the standard we have assumed, are: —

1. Does this method remove them with regularity and celerity?

2. Is it convenient — not involving much labor of householders or others?

3. Does it avoid offense to sight and smell, and contamination of soil or water?

4. Is it expensive?

5. Does it contemplate utilization, and how?

6. Will the utilization pay its cost and leave a margin of profit?

Under this review come naturally, in nearly their chronological order, the dry-earth system, as earliest of record; the vault and cess-pool conservation; the sewer and water-carriage plan; the portable "pail system," in its variety; and the pneumatic system.

All these, as is well known, have existed under widely varying forms and modifications, but are to be considered as usually presenting themselves, and upon the principles which underlie and govern them.

The Dry-earth System. — This system, which contemplates the addition, by more or less elaborate mechanism, of about one and a half pints of perfectly dry earth, ashes, or charcoal to each dejection, and the ultimate storage and application to the land of the product, answers our queries as follows: —

1. It does not in practice either quickly or very regularly remove the excreta from the place of production, though, if properly used, they are, during their brief retention, possibly held in innocuous form.

2. It is, as a rule, of very convenient use and application, though it requires some labor to prepare and replenish the dry earth supply and remove the soil.

3. It is inoffensive either to sight or smell when properly cared for, when the earth is dry and abundant, when not used as a urinal, and when the soil removed is kept dry; but a slight neglect entails offense too generally present.

4. The original cost is small, as also its operating expense.

5. The material produced is in good form for utilization, either by application directly to crops, or in compost, and may, by successive passings through the closet, be additionally enriched; a practice, however, not advised.

6. It will, under favorable circumstances, pay all expenses, and a slight profit.

Professor Voelcker, the analyst of the London Agricultural Society, has expressed an opinion that earth-closet manure has a value but little in excess of that of an equal amount of meadow-muck, and only sufficient to pay for its cartage a distance of half a mile or so. The experiments of Governor Armytage at the Wakefield (West Riding) Prison in England, as well as of others, show a practical result entirely beyond that stated by Voelcker, and suggests the conclusion that, while the sum of the integral values found by analysis does not foot up other than as given by the chemist, a potency so subtle as to elude chemistry, and which indeed is destroyed by analysis, resides in the united whole, and possesses a fructifying power in the alchemy of nature that alembic and retort cannot define. One of the Baronets Rothschild, at a small hamlet in England owned and rented out by him, has established the exclusive use of the earth system, and has it wholly within his control, supplying the dry earth regularly, and removing the soil, which is applied to his agricultural needs in the vicinity, and from this small village secures an annual net profit of $600. In short, for individuals, seaside, or country hamlets closely built, public institutions where the management is regular and under one control, with use for the material, it may and should be a success; although in very large institutions, and especially insane asylums (particularly having large numbers of females), it is attended with so much labor and difficulty as to quite preclude efficiency.

The large amount of soil required, however, its cost, the difficulty of bringing it so far as would be unavoidable, and the collection and removal, with their cost, are obstacles to its adoption in towns and cities that cannot be overcome.

The Vault and *Cess-pool* plan of conservation, and the ultimate removal of their contents by some manual method, is the one still most largely in use over the country, and must long continue so to be.

1. It does not promote either the regular or the speedy removal of the excreta therein deposited, though these may, by the addition of various agents, be rendered comparatively innocuous while retained.

2. While, as usually constructed, remote from dwellings, it is not convenient, it offers a ready method of meeting a demand of small prime cost.

3. It is usually offensive in use, and, until recently, in process of cleaning, and is potent in polluting land and the water sources.

4. In the long run, it is in cost of construction, repair, and cleansing of considerable expense to the individual, fully equal in a term of years to his *pro rata* tax for sewer or pneumatic accommodation, and much in excess of the cost of an earth closet.

5. It retains only the lowest value of the excreta, parting, as they do, by chemical change during their long storage in vaults, with the chief of their manurial constituents. They have still, however, some value as fertilizers applied directly to certain crops, or used in compost.

6. Until recently, owing to the cost of removal, the use of the excreta from vaults has not been profitable, but by new and improved agencies has now become so; and by these agencies this system, which we have seen to be — as compared with our standard — far from equal to the requirements, we shall find deprived of some of its chief evils and rendered remunerative. Although as a system it must ever continue to rest under the ban of sanitary science, in view of the facts that it is "by a large majority" the prevalent one, and that it must inevitably long so remain, the amelioration of its conditions is matter for congratulation, and marks an era in the progress of sanitary affairs. Fuller consideration of these improvements we shall presently reach.

The Sewer and *Water-carriage System* of the removal of excreta, having a remote antiquity, and presenting itself in various forms of adaptation, has come to be generally considered as the chief of the several plans for the removal of human waste.

1. It regularly and speedily removes all excreta from the point of production.

2. It is by far the most convenient of all forms hitherto generally adopted.

3. It secures the minimum of offense to sight and smell, and of injury to contiguous land or water.

4. Its expense is large in original construction, appliances, repairs, and the use of water, the latter being a very considerable item.

5. It does not leave the excreta in the best form for, or permit its utilization by any method except direct irrigation of land. The large volume of requisite water dilutes the manurial values, prohibits by the expense successful manipulation for fertilizers, cement, or other compounds, and when introduced to streams, etc., is powerfully active in their pollution and obstruction, the death of fish, etc.

6. Only in irrigation has it been profitable, and only then where conditions have favored.

While the history of sewage irrigation dates from antiquity, and has a record of success in its modern applications that is well known, it is so exacting of conditions of area, topography, climate, and location, that only when all these conditions are propitious is it available. The Craigentinny meadows of Edinboro, perhaps the oldest, and certainly the crudest of modern sewage irrigation farms, holds these conditions in the main in high degree, and has proved successful, paying an annual rental of £25 and £30 per acre. The Croydon Farm, established by and conducted under the eye of Alfred Carpenter, has also shown wonderful results, which in turn have been fully equaled by the operations of Mr. William Hope, V. C., at Breton Farm, Rewford, and elsewhere. Fifty tons of mangel-wurzels, or eighty tons of Italian rye grass to the acre (eight crops per year), being a not uncommon yield, all, however, depending on the existence of the requisite fortunate conditions.

Aside from its attendant expense of construction and maintenance, which its small capacity for utilization does little to offset, the sewer and water-carriage system would seem to present in greatest degree the desired elements of excretal disposal. The facts, however, that the flow of sewers when entering streams, lakes, etc., is of incalculable injury in various points of view, that sewer gases are found to hold large power for harm, and that irrigation of land is very much restricted by topographical and climatic considerations, compel further search for a satisfactory agency of disposal.

The "Pail System," so called, which, under various devices at several points in Europe, has attained use and celebrity, and which consists simply in a comprehensive supply, control, and removal of wooden or iron receptacles for excreta, used in numerous patterns and with various forms of deodorizing and disinfecting agents, as ashes, etc., etc., has as yet found little favor in this country, and readily gives place to the allied but less objectionable earth closet.

1. It removes regularly, but daily only, the accumulated dejecta.

2. It is not convenient, involving as it does accurate adjustment, adequate supply of deodorants, much publicity, invasion of premises, and noise in its management.

3. It is rarely entirely inoffensive to smell, and less rarely to sight.

4. It involves in its proper control large expense in original outfitting and care.

5. The material is in different conditions of availability as a fertilizer dependent upon the character of the deodorizing agents used. In the main, however, it is valuable by application to grass and other crops direct, but more so in compost use.

6. None of the several pail methods in vogue have ever proved profitable as conducted, despite statements to the contrary, the enormous expense of the furnishing and care having eaten up the returns.

Under the somewhat visionary and over-persistent advocacy of one Alderman Taylor, the pail or "tub" system became, a few years since, very generally introduced in the city of Rochdale, England, and, with the exceptions of the similar employment of the Goux method in certain continental towns, and the use of the "Tinnette" system in Paris, has afforded the fullest illustration of this means of excreta control. Although the corporation of Rochdale itself has seemed to be well pleased with its experience, and has published exhibits of results as justifying their experiment, the later publication of facts in reference thereto prove conclusively that the material has not found sale, that the method is offensive, the corporation heavily involved, and the result unpopular, as well as non-sanitary. The experience of Paris with its "Tinnette" system and manure manufactory has, though long advertised as most successful under the management of an English company, proved also ruinous. The projectors, who had large works at Bondy near the city, and conducted matters on a grand scale, have failed not long since, and the enterprise is at a stand-still. The cost of maintenance in this case, as in the others, more than consuming the returns, although large, derived from the product.

We come last to *the Pneumatic System*, in its fullest and best adaptation, known as the Liernur System.

From our consideration of the foregoing methods it has become readily apparent that a system is yet demanded that, while it regularly and speedily removes excreta in the fresh state from the vicinity of man's abode, must do so without offense to the sight or smell; must also be free from dangers to soil and water sources, contiguous to habitations or remote; must possess cleanliness, and a reasonable degree of convenience in access and appliance; should be of the least possible expense in construction; should be comprehensive in its scope and certain in its action; should preserve undiluted the manurial values of the excreta dealt with, at the same time that it avoids all possible waste of water; and, in the shortest, simplest, most direct and profitable manner, returns to the soil that which had originally been taken therefrom.

Recognizing these requirements, Captain Charles Liernur, an American by birth, but long resident abroad, has undertaken to supply a system based upon pneumatic force which shall at once in its entirety accomplish all the desiderata above enumerated. The following is an outline of his system as variously adopted:—

The iron soil-pipes of all the dwellings of a neighborhood are continued at full size to the iron "mains" of the streets in front or rear of the premises, joining these at an easy curve. These "mains" converge at the most convenient street corner, or intersection, in one common pipe, which enters an air-tight, wrought-iron, boiler-like receptacle or tank, sunk under the pavement. In the pipe entering the tank and close to it is a gate controlled from the street. This tank or receptacle (of which there are many over the city) is connected by iron "mains" with similar tanks of larger size at the central works. Large air-pumps operated by a steam-engine create a vacuum in the large tank, and a gate in the "main" being opened, a vacuum is then created in the underground tanks at the street intersections. The gate near the underground tank is then opened, and the vacuum draws the accumulated contents of the house-pipes with great force into it; a new vacuum being made at the central tanks the contents of the corner tanks are drawn thither, and hence silently, without offense to sight or smell, without even the knowledge of the citizens, the excreta of all the dwellings are once or twice daily removed to the central works, where they are instantly converted into poudrette by the following process, namely: The contents of the soil-tanks are drawn off into retorts, sulphuric acid is added to the extent of one per cent. of the volume. By the aid of a revolving "stirrer," this is thoroughly incorporated in the mass, fixing the free ammonia, while reducing the whole to the desired consistency. The semi-fluid material is then led by pipes specially constructed over the upper surface of a revolving drum of sheet copper of large dimension, heated inside by a steam coil, and rotating in a heated brick chamber.

The thin layer on the drum is dried by a single revolution, and removed as poudrette by the scraper-knife which impinges on the drum just under and behind the flow-pipe. The poudrette falls into a box, and its return to the land at any distance becomes only a question of barrels and transportation.

The conveniences of the house-closets in this system have been described by Krepp as follows:—

"A vertical pipe of brown stone or pottery-ware runs from the basement to the top of the house for the privy funnels of the different floors to discharge in. The funnels are made of white stone-ware, smoothly glazed inside, and have a peculiar shape. The rear part of this funnel recedes, instead of having the dish-form of ordinary water-closet basins, which is invariably struck and soiled by fæces discharged at about a right angle, requiring a great deal of water to clean it again. On the contrary, by the plan described, the excrements, entering more or less in a slanting direction, fall upon the front surface, which is steeply inclined in the same direction, whilst the rear part of the funnel remains altogether untouched. Whatever stain is left in front is immediately washed away by the urinal discharge. Any one may satisfy himself of the perfection of this simple arrangement, by noticing that in a smooth water-closet basin no matter is ever found adhering to the front part. This is partly due to its being continually washed clean by the urine, and partly to the acute angle under which the excrements strike this front.

"The short funnel terminates in a sort of downward, drooping lip, tapering off to a rounded point, which conducts the excrements towards the middle of the vertical pipe, so that in dropping off that lip they descend through the space alone, without ever touching the sides of the pipe, which, consequently, are kept clean. To make quite sure of this, the vertical tube is fourteen to sixteen inches wide, depending upon the number of privies entering into it. For purposes of ventilation this pipe is prolonged to the roof of the house like a chimney, and covered with a wind-cap turning upon a pivot, so that, with all breezes, an uninterrupted exit of gases can take place. Below, where the excrements accumulate, the vertical pipe is made of cast-iron, and narrowed down to a diameter of about five inches, curving towards the house-valve, first downward and then upward, so as to form a sort of hydraulic trap. This bent cast-iron portion of the tube is of easy access in the basement or cellar of the house, and may be removed in case large, unyielding objects, such as broom-handles, pieces of wood, etc., should happen to be thrown into the privy by careless servants or children. The excrements, solids and fluids, are all, without any impediment, collected in this bend, thus offering only a surface of some five inches diameter to the air for evolving gases. Experience has shown that fermentation evolving sulphureted hydrogen and ammoniacal gases sets in only some three or four days after excrements are produced, and that the gases thrown off in the interim are mere watery vapors, tainted only with a trace of ammonia;[1] therefore but very little offensive effluvium will arise from the contracted surface of the said hydraulic trap, which is besides entirely cleaned out every twenty-four hours. To prevent, however, even the smallest volume of fæcal gases from entering the *houses, the privy funnels are furnished on the seat* with a lid turning on a strong, continuous brass hinge, and provided on the inside with a good India-rubber ring, one inch wide, and projecting about

[1] This slight exhalation even ceases when the matter becomes cold.

one-eighth of an inch. This India-rubber ring serves the double purpose of giving a really air-tight closure, and of preventing the noise the lid would otherwise make in falling. It is evident, when such a lid is opened for use, a current of air must at once set in downwards through the funnel, and then upwards through the vertical pipe to the roof, creating a draft just like a chimney, for the simple reason that the pipe being closed below, no air can rush in from that quarter. It is therefore impossible that any offensive gas should escape through the funnel, as that would create a partial vacuum in the lower part of the pipe. The only chance for a momentary suspension or weakening of this air current would be the simultaneous opening of privy lids on two different floors, which of course will not occur very often. The funnels are manufactured with drooping lips of different lengths, those on the upper floors projecting the farthest, so that excrements falling from a higher funnel cannot strike the lip of a lower one. By these means a good substantial closet is provided, in which nothing whatever can get out of order, as there are no valves, or traps, or machinery of any kind. When the lid is opened nothing is seen but a short, clean, white funnel, with a dark outlet below, emitting no effluvia whatever, and never offending our eyesight in the manner so often presented by ordinary water-closet basins, quite choked with a disgusting mass of excrements and soiled paper, whenever the fixture is deranged, or when there is a short supply of water, or when some careless individual has forgotten to work the handle. Both fæces and urine falling free from a comparatively great height into the hydraulic trap below, they are by their own gravity pounded together into one homogeneous mass, to which the paper used gives a sort of consistency and tenacity, greatly facilitating the daily cleaning process, by offering a sufficient resistance to the column of air rushing in through the ventilator on the roof, the very moment the house valve is opened in the manner before described. As we said before, this atmospheric pressure, equaling a force of some 200 pounds in a five-inch pipe, will suddenly, like a hurricane, sweep away even the last vestige of matter collected in the hydraulic trap, thus leaving the whole privy pipe entirely cleaned out. So powerful is the force operating, as experience has shown, that not only all solids, fluids, and gases, together with the troublesome flies infesting all privies —above all, in hot countries — are completely swallowed down, but that old shoes, rags, and even small brickbats, are likewise hurled into the street reservoir as if by magic. To give the reader a just conception of the force employed we must remind him that a hurricane or tornado, which tears trees out of the ground by the roots and flings them along; which unroofs buildings, knocks down chimneys, and drives their bricks along like hail, has a measured pressure of 50 pounds per square foot only. The power applied by the pneumatic system being about 10 pounds per square inch, or say 1,500 pounds per square foot, is thus equal to a combination or concentration of some thirty tornadoes; when such a force is suddenly exerted to move a plastic mass, exceeding but seldom one foot cubic, no wonder that it disappears so quickly!"

As witnessed at Amsterdam, Leyden, and Dordrecht, although complete only in the latter place, it was found to accomplish all claimed, except that it was not without offense, and is, in first cost, enormously expensive. As subsequently seen by Dr. Folsom, of Boston, it was chargeable with the same faults. Later improvements, a recent letter from the inventor informs me, have remedied the defect; as to odor, in what manner is not made clear.[1] As to the matter of expense, great as it is, if the figures given by the Dordrecht authorities can be relied upon, it becomes a matter of small moment, as the sale of poudrette, for which they find ample demand, is rapidly creating a sinking fund, which will speedily wipe out the original outlay. It would appear, then, that in this system are gathered more of the desiderata and less of the errors than in any of those we have reviewed, and until displaced by evidences of failure, or the advent of a better, may fairly stand as the highest type of agent for both the removal and utilization of domestic excreta.

It is, however, noteworthy, that with the single exception of the product of the water-carriage plan, the excreta removed by all the systems are available for and possibly, even probably, profitable in utilization, and wherever sewerage can be used in irrigation, or can be cheaply enough reduced to poudrette by the Liernur plan, it proves no exception to the rule. In those instances, as of the "pail system," where unprofitable, it has been because of the expense attendant in the working of the system, and not incident to the utilization of the product. That irrigation is largely profitable has been already shown, and wherever climate and topography favor, there is no reason why, with adequate knowledge of its peculiarities, the same results should not obtain. Accepting then the system of Liernur, as described, as the fullest embodiment of correct principles, it becomes of interest to see to what extent somewhat similar processes, by portable machinery, have effected improvements in existing unfavorable conditions, and have wrought results directly in the line of advance sought. The common privy-vault and cess-pool comprising, as is well known, by far the great majority of the agencies for the disposal of excreta, it is with them as existing features that we have now most largely, and for a long time, must continue to deal. The ultimate diposal of excreta collected under this plan of retention has long been recognized as a nuisance and a peril, — the magnitude of which can be best understood when it is known that in the city of Philadelphia there are eighty-two thousand vaults and cess-pools, of dimension varying from three and one half to fourteen feet in diameter, and from five to forty feet in depth, some of them not having been cleansed in a hundred years. The city of Washington and suburbs has fifty-six thousand boxes and cess-pools; the city of Cleveland, twenty-five thousand; and the good city of Chicago, I am informed, even with the splendid sewer system of Mr. Chesbrough, not far from thirty thousand. From ancient times the habit has been, both here and in Europe, as fast as a vault or cess-pool was filled, either to cover it over, dig a new one, and leave the old to poison the soil and water-sources around, or to have the contents removed by a horde of night scavengers, with their dolefully familiar accompaniments of leaky tubs, buckets, and wagons, uncanny noise and vile stench, banishing sleep, and poisoning the air for days. De-

[1] Later advices from other sources confirm the statement.

struction of property, danger of fire, and befouling of the streets frequently marking their course.

Various attempts have been made in Europe and in this country from time to time to so perfect the character of the vaults themselves, and the enginery of removal, as to permit of this necessary but unseemly labor being performed with greater sanitary success, without offense to sight or smell, under the light of day and the purifying influences of the sun.

The character of the receptacles themselves, being so variously conditioned, and under so purely personal control, has unfortunately undergone little change for the better in any quarter;[1] but the advent of "odorless excavating apparatus," as the improved enginery for removal is termed, has induced, in certain cases, the construction of water-tight vaults and cesspools in contemplation of frequent removal by the new process.

We have seen that in the Liernur system the process consisted in creating a vacuum in a proper receptacle, filling it by atmospheric pressure, and (under one stage of its progress) in then driving it by compressed air into an air-tight vehicle for convenient transportation, all noxious gases being subjected to the destructive action of fire.

The several earlier attempts at an inoffensive removal sought also by pneumatic force (which was obtained in several ways) to remove the contents to air-tight wheel-tanks.

The oldest and crudest of these methods, still practiced at Milan and elsewhere, has received the high-sounding title of "hydro-pneumatic force," and is described by Krepp as follows: —

"A sort of box reservoir, containing 20 cubic meters of water, stands with its bottom $2\frac{1}{2}$ meters above the ground. Under it, sunk half in the earth, lies an iron cylinder of $1\frac{4}{10}$ meter diameter, and of 16 cubic meters capacity. A pipe conducts water from the reservoir into the cylinder and fills it. A pump, worked by a yoke of oxen, pumps the water out of this cylinder again, after every other opening has been shut; the result is a vacuum in the cylinder below. The pneumatic wagon cylinder is now backed up to the reservoir, and also filled with water, which, by means of a connecting pipe, is then emptied into the evacuated cylinder below, leaving of course a vacuum behind in the wagon cylinder. As the latter contains only 2 cubic meters, eight such cylinders can be simultaneously evacuated by connecting them with the apparatus. Of this round-about way of establishing a vacuum the good people of Milan seem to be very proud, never taking into account the amount of force needlessly spent by constantly moving about such great masses of water. The same result could of course be obtained much cheaper by applying a steam air-pump direct to the wagon cylinder to be evacuated."

"Another mode of making a vacuum in the wagon cylinder is used in

[1] In the city of Washington, the national capital, its sanitary interests governed too by the best organized and equipped Board of Health in the country, the great majority of the privies are simple pine boxes, often leaky and rotten, some three feet long, fifteen inches deep, and eighteen inches wide, set upon the floors of the privies, offensive and foul continually; a relic of an old and unthinking age not too soon abolished.

Turin by filling it with water and allowing this to discharge into a vertical pipe of 36 feet in height, with a short bend below like a barometer. The cylinder will of course entirely empty itself both of air and water, when the valve is closed and the wagon is ready for use. This method requires, not only abundance of water brought to that height, but also a clear fall of 36 feet for the free discharge of it."

"A still better arrangement for emptying cess-pools is the more modern one, by pneumatic pressure, by which the pumping wagon is dispensed with, and only the receiving cylinder used. When about to be employed, this cylinder is filled from a small stationary boiler with steam of about 1¼ atmospheric pressure, which drives all the air contained in it through a chimney containing a charcoal fire to make it inoffensive. When the cylinder is filled with steam, the valve is closed, the connecting pipe detached, and the wagon drives to its destination. During the transit the steam condenses, leaving a perfect vacuum above a little water collecting in the bottom. To empty a cess-pool it is then only necessary to fasten one end of a hose to a coupling socket on the cylinder, and lower the other end into the pool. The moment the valve in the socket is opened, the air forces the sewage matter into the cylinder, until the gases collecting in the upper part balance the pressure of the atmosphere. The resistance of these gases prevents the filling of the cylinder to more than about three quarters of its capacity, the suction being very powerful in the start, but gradually slackening off, until brought to a dead stop by the above cause."

In 1858, Mestdagh, of Antwerp, invented an apparatus in which, by the action of a pump with "bellows valves," he sought to transfer the material directly through his pump and force it through hose into his tank. Modifications of the plan were afterward instituted by Motte, of Paris, and the apparatus has for years done service in that city and elsewhere. This pump may be described as follows: —

"Two large bellows, having their nozzles turned towards each other, communicate through their valve openings with a roomy pipe, to which a three-inch suction pipe is attached; a lever, pivoted in the middle like that of a fire-engine, operates upon the bellows in such a manner that when one is raised the other is depressed; which alternate motion first sucks the fæcal matter, and then forces it into the ascending three-inch pipe. This pump, costing about £20, is placed upon a little wagon carrying also the hose and other fixtures. An iron receiving cylinder, 6½ feet long and 3 feet in diameter, lies upon a separate carriage, and generally remains in the street whilst the pump is placed as near the cess-pool as practicable. A three-inch hose laid through the house, court, or garden, establishes the communication between the pump and the receiving cylinder."

A few years later Schiettinger, of Mühlhausen, brought out an apparatus in which the effort was also made to pass excreta through pumps and hose, and to consume the gases. Similar apparatus was introduced by Berger, of Nuremberg, and others.[1]

[1] Strauss, of Louisville, Ky.; Windenthaler, of New York; Hobbs, of Washington; Painter, Keizer, and McCauley, of Baltimore, Md.

In 1862, Walter introduced in America an apparatus by which it was sought to secure a vacuum in a large tank on wheels by the action of air-pumps attached to the tank and geared to the wheels, being operated by the latter as they rolled through the streets. Modifications of this plan by Retowsky and Datichy, of New York city, followed. Many devices for steam-injected tanks and pneumatic apparatus have also from time to time been brought forward on both sides of the Atlantic. It has, however, been reserved for American inventive genius to produce the forms of apparatus which are recognized to-day as the most efficient.

By what criterion is such efficiency and supremacy to be judged? It is interesting to observe that almost precisely the same conditions are requisite in this portable enginery which we have considered as essential in the permanent and general system, namely: What will most quickly, inoffensively, conveniently, and cheaply do the work, and leave the material in best shape for most profitable return to the soil?

The forms of "odorless excavating apparatus" at present in use with varying success, being all worked by hand, may be grouped in three classes: —

1. That class whose chief distinguishing feature is a pump of peculiar construction (there are several in the market), through which all the material is passed by alternate suction and force, lines of rubber hose connecting the vault, pump, and the final receptacles (tanks or barrels) on trucks.

2. That class which passes no excrements whatever through the pump, but employs an air-pump to create a vacuum in a tank, receiver, or barrel, which is in effect a second chamber of the pump. The vacuum in this receiver being filled by the vault contents through connecting hose, the air-pump compresses air in the receiver, expelling the material through hose, any distance, to the tank or barrels upon the wagon.

3. That class where an air-pump is used simply for creating a vacuum in a small receptacle, as a barrel, which requires to be brought into close proximity to the vault, and is itself the final receptacle, being both brought to and carried from the spot by severe toil.

All the various form of apparatus now in use may be properly classified under one or another of these three heads. Under the first there are five styles of apparatus in use, of which three are capable of good work, two being inferior; but of the five it is probable that two, or at most three only, have valid existence under the United States patent laws.[1]

Under the second class there is but one apparatus comprising the latest invention.

Under the third there are four to which United States patents have issued. Of these, one, the original, proved impracticable; another in part so;

[1] The five are the inventions of Keizer and Painter, of Baltimore, Md.; Matthewmon and Johnson, of New Haven, Conn.; Rankan and McCauley, of Baltimore; Hememan of New York city, and Berger. Of these, Keizer and Painter's, Hememan's, and Berger's, have long been known. The last two are of little value, while McCauley's and Matthewmon's pumps are said to have suffered decrees against their validity in United States courts.

the third is in use to some extent; and the fourth is but a copy of the second.

Practically, the election of apparatus of this kind is narrowed down to a single representation of each class, and comparison with the standard we have established must determine which of these is, all things considered, the best for general use in ameliorating the evils that attach to the inevitable existence of vaults and cess-pools. What is fairly deducible from such comparison? We have seen that in general systems of sewage control the pneumatic method of Liernur most rapidly, safely, unobtrusively, and efficiently removes the accumulations of dwellings to the place of reduction into fertilizers. In the earlier history of this plan, the street tanks had their vacuii created by the air-pumps of a locomobile which was brought near to them, and, when filled, their contents were expelled by forcing compressed air from the pumps in upon the material, causing its propulsion through hose any distance to a wagon tank. It is clear, then, that this near approach to a portable form of the approved features of the Liernur system affords at once a standard and a suggestion for the principles and construction of lighter "odorless excavating apparatus." A portable Liernur system then is, in a word, the result sought.

The representative of that class which aims at pumping material directly through its valves, while having no comparison to the plan of Liernur, is an invention of great merit, and is undoubtedly the pioneer in successful work in this country. It is manufactured at Baltimore, Md., and uses four-inch rubber hose. Its pump weighs nearly seven hundred pounds, and requires four men to operate it. Its valves are most ingenious inventions, and are unique. Its work is done in an effective way, and it is built in a most thorough and substantial manner. It exhausts the material through suction hose, passes it through the valves of the pump lengthwise, and forces it through leading hose into large tanks or barrels, with the top of which small furnaces are connected for the consumption of gases. Its seeming defects are, that: —

1. It is too heavy and cumbrous, requiring a separate wagon for the pump and hose alone.

2. Its original cost is too great, as also the expense of operating it (involving as it does an extra horse, wagon, and driver to carry it, and so large a force to work it).

The parts of the pump are rapidly worn, and are difficult of access in case of accident. A serious defect lies in the method by which it is continually exhausting gases from the vault, forcing them into and compressing them in the tank, a process which has recently resulted — either from such compression, or their ignition in the compressed state from the furnace on top — in the explosion of several tanks in different cities, in one instance instantly killing the driver, and in all of course occasioning an unpleasant *shower*. Its chief advantage is its facility for the rapid removal of large quantities. Its chief defects are its expensiveness, which debars its use in any but large cities, and the danger which lies in the principles of its action, whereby it compressed the light gases in perilous amount and contiguity to fire. It has been in the market some six or seven years, and is in use in several large cities.

The sole representative of the second class is manufactured at Philadelphia, and is exactly a portable Liernur system. It aims at efficiency, with lightness and small expense, and thus to meet the general demand of small cities and towns. It consists of a double-acting air-pump on wheels, weighing three hundred and thirty pounds, with one-inch air-hose attached. A pump-receiver (in effect a second chamber of the pump), which is a strong forty-five gallon barrel, made with special gates and fittings. Sufficient three-inch suction-hose (costing $1.00 per foot less than the four-inch, and practically better). Any length of three-inch rubber "leading" hose, and two small charcoal furnaces. The air-pump is coupled to the receiver-barrel, the suction hose to the gate-nozzle of the receiver-barrel at the top. One end of the leading hose is attached to the nozzle at the bottom, and the other to the top of the wagon-tank or barrel to be filled, which may stand at any reasonable distance. A furnace is attached to the pump and to the wagon-tank. In working, the pump exhausts the air from the receiver-barrel, a vacuum is created, and the material from the vault flows in. The air exhausted is forced from the pump at each stroke into the furnace, and is at once consumed. The receiver being full, the action of the pump is reversed, and the compressed air forced in upon the material, which, the lower gate being opened, is expelled through the hose into the tank, where any residue of gas is consumed by the second furnace. It requires but two, or at most three, men to work it, is carried on the same wagon with the barrel or tank, and is so light as to be easily carried through a house if occasion requires. It must have all its connections absolutely tight to secure the most efficient work. It has been in use two years, and is in sixteen cities, towns, and corporations. Its analogy to the early style of Liernur is claimed to be complete. The representative of the third class has practically the same pump and hose, but creates a vacuum only in a barrel, and, that being filled, the barrel, which has been brought into the yard, perhaps through the house, must now, in the filled state weighing four hundred pounds, be carried back and lifted upon the wagon from which it came — a task of genuine labor, as all who have seen can testify. With both of the first two styles named, either a tank or barrels may be used as receptacles; but, as cheaper and lighter, and especially as favoring transportation of the material to the farmer, barrels are believed to hold decided advantages.

By the methods and agents we have reviewed, it is fairly evident that both the removal and utilization of excreta and kindred waste of our communities may be accomplished under satisfactory conditions of speed, safety, economy, convenience, and utility. Even the obnoxious and dangerous vault and cess-pool are in good degree made amenable, while they remain, to proper sanitary and economic control.

The offensive but often valuable contents of the vats of manufactories, tanneries, bleacheries, etc., also find in the "odorless excavating apparatus" an approved method of removal to the land; while work-shops, factories, and dwellings, freed by these means from much of the offensiveness of former methods of removal, will no longer have excuse for foul privies, etc., as sources of discomfort and disease.

Emerson has well said "The first health is wealth." No better illustration of his proverb can be found than in that comprehensive system which effects simultaneously the *proper removal* and the *proper utilization of domestic excreta.*

XI.

THE WORK OF HYGIENE IN THE EDUCATION OF CHILDREN IN THE COMMON SCHOOLS, AND IN THE FAMILIES AND SOCIETY IN WHICH THEY LIVE.

READ BEFORE THE AMERICAN PUBLIC HEALTH ASSOCIATION, SEPTEMBER 28, 1877, AT CHICAGO, ILLINOIS.

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A FEW definitions at the outset will save discussion, make clearer the object of this essay, and facilitate the consideration of methods. By health is meant: "The most perfect action of body and mind during as long a period as is consistent with the laws of life." — PARKS.

Hygiene, as a science, has for its object the discovery of the natural laws which determine the condition of health, and the influences by which it is perverted, impaired, or destroyed before the natural limits of life have been reached. As an art it aims at the use of means to maintain health, or to prevent, remove, or palliate the operation of injurious influences when possible.

As an art hygiene has two great sub-divisions: —

1st. Personal or private hygiene, including methods for use by individuals and families.

2d. Public hygiene — methods of maintaining "that condition of the individuals of a nation which enables them to discharge rightly their respective functions in the state, to do their duty in that state of life to which they have been called." — ACLAND.

The latter includes the first. As a science they are one. As arts they differ only in the methods of applying common principles, and so in practice are distinct.

I take it be fully conceded that if the principles of hygiene, already established, could be practically applied by methods at present available in the conduct of every-day life, the advantage to individuals and States would be so great as to be inestimable. Life would be prolonged; capacity and inclination for work, as for pleasure, would be increased; labor would be encouraged; disease and ill-health diminished in frequency and quantity; death made more remote, and more natural; physical, mental, and moral failure be lessened; and vice and crime be less frequent and terrible.

The disciples and advocates of public health have taken three general methods to attain these, so desirable, results.

1st. Demonstration of the value of hygiene by actual test. This they have done most successfully in the department of State or national hygiene. As results, they have secured legislation enacting popular obedience to such regulations as vaccination, and the seclusion of the victims of infectious and contagious diseases; the regulation of unhealthful trades; the sanitary control of sewers and lodging-houses; and the organization and powers of local and State boards of health.

2d. The organization of such societies as the "American Public Health Association," and the use of the public press for the publication and diffusion of their transactions and reports, as also other papers on special topics.

3d. The introduction into colleges and schools of instruction in practical hygiene by text-books and lectures.

The success of these efforts is, as yet, far from perfect. It is, in fact, hardly satisfactory. While there is still a very great lack of sanitary knowledge among all sorts and conditions of men, there is, as we have abundant evidence, a very marked popular desire for more light in this direction.

The much lamentable and discouraging fact is that practice, public or private, is not proportioned to knowledge. Common and self-evident as is this failure, even profound sanitarians, sometimes, seem to forget its influence in discouraging or delaying progress. If it were not so, it would be superfluous, here, to urge that belief is barren without practice, and that the most accurate knowledge, conjoined with the most persuasive power of influencing others, too often co-exists with the most flagrant neglect to do for one's self what he preaches ought to be done.

I propose in this paper to inquire how we may further avail ourselves of existing educational facilities to give practical knowledge of hygiene to the people, and to restrict myself to that department of education which prevailing methods compel me to call lower education. I do not know who is responsible for this distinction, but that it is constantly made no one familiar with educational literature will deny. It has grown up, perhaps, out of the so-called systematization of educational methods, which is a favorite pursuit with some of our professional teachers. They seem aiming to graduate not only pupils, but doses of knowledge, by regulating its quantity and quality. This they do not with reference to the individual necessities of the scholar, but to the grades in schools. They are even apportioning with great precision the number of hours which shall be devoted to each department of knowledge in the course of every pupil's scholastic education.

From the stand-point of public health this system lacks something of adaptation and completeness, from the fact that there is great difference of capacity among pupils, and a very great difference in the time which individuals can give to the whole of their scholastic education, the great majority, more than eighty per cent., never going beyond the grade of the common schools.

The graded system of schools (new in some States, including the university) claims, and justly, too, from its stand-point, that failure is not its fault if its conditions are not fulfilled. All this and more to like purpose is true, but we cannot ignore the fact that so small a minority of our people are able, or willing, to avail themselves of the system in the scholastic education of their children. The point I wish to make here is evident then; that to reach the great majority of American children during their scholastic training, the common school affords the only practical method. In the school classification, already refered to, the line between upper and lower is drawn at or above the high schools of cities. The university, colleges, technical schools, and possibly high schools, therefore, afford the higher education, while the duty of the common and graded schools is to afford the lower.

It would be very interesting to consider the question suggested by this classification, as to the relation of the terms higher and lower, in the sense here used, to the sometime forgotten or ignored matter of practical utility in every-day life. Fortunately this question of practical utility is the favorite one as a test of common school education, so that I may be permitted to pass the *quæstio vexata* of culture, æsthetic, symmetrical, and complete, up to that higher scholastic training with which, in this paper, I have nothing further to do.

The education with which we are here concerned is afforded by the common and graded schools. It begins at the age of five years and ends at, or about, the fifteenth year. It is, as a rule, all of scholastic education the pupils are ever to receive. It is, however, but one department of their education, — the other one, which I will call lower too, as distinct, in many important respects, from the parallel one of those who receive the higher scholastic education, is given in the family, and by the society in which they live.

It is impossible to determine the use to be made of the common school in imparting a knowledge of the laws of health, without taking into account the work which must also be done in the family whose influence precedes, is contemporaneous with, and outlasts that of any school. Due weight has not been given to the family and society in calculating the influences which together supply the education which children receive.

The family preceded society, the church, the state, and the school. In our civilization it co-exists with them, but its duties have, in so many respects, been delegated to other agencies, that it is really a difficult problem to determine what its real functions are now supposed to be, even by our most cultivated classes. From the stand-point of hygiene there is very little doubt on the subject. The family is the social unit which must exist and be healthy before the other organizations, which it alone makes possible, can exist and be healthy.

The home is the physical centre of family life. It was, and is, in many important respects, the church and the school-room for children. This character of family and home can never be lost without the destruction of family, and all which upon it depends. The existence and maintenance of the relations of man and wife; of parent and child; of brother and sister, and of kindred, are fortunately not the results of human devising, but their necessity is a law of human organization, and their use is as natural and instinctive as to breathe pure air, to drink pure water, or to seek for and enjoy the heat and light of the sun.

The family, then, is the first school, and the home the first school-house, in the lower education we are discussing.

Other agencies are, in fact, only coöperators in the work which it is the duty of the family to inaugurate and direct.

They are the specialists, if I may so say, of whose services the parent ought to avail himself in the education of his child; but to whom he ought never entirely to resign its direction.

This is the natural method. It is evidently what ought to be, but how different from the actual fact.

Even in childhood the association with others than one's immediate family is a necessity of development and growth. Much more is this true of youth and adult life.

The society of any given locality is, in many respects, though not all, what the families and homes of its population make it. Such society is the next step in social organization beyond the family. It is the great family of the neighborhood, to which are delegated many powers influential in the education of children. Society in its largest sense makes necessary the organization of the church, the school, the town, the city, the state, the nation, the trades, and the professions, and it enacts laws by which its growth is perfected and protected from danger within or without itself.

But in all this complex and often artificial organization of which our civilization is the result and the evidence, the family is still the fountain and source of power and of life.

As respects our present purpose, therefore, it is the real objective of all sanitary instruction, as it is already admitted to be of sanitary work.

I go a step further and insist that this is true even as respects scholastic education in hygiene.

The public schools reflect very nearly, in the long run, the popular demand both in the kind, quantity, and quality of the instruction they afford. The demand is determined chiefly by the sense of any given subject's importance in the majority of the families of a district who are instructed in it.

Now, as respects hygiene, it must not be forgotten that the number of families whose lives, or homes, are in accordance with the simplest sanitary rules is very small.

Any health officer, or family physician, can testify, from only too abundant experience, that a marked increase in disease in the family, or an impending epidemic, are almost the only influences which can awaken an average householder to the necessity of looking *at home* for causes of sickness or death. Long habit has benumbed the senses of most people not only to bad odors and nuisances at home, which they recognize and condemn very readily elsewhere, but it has caused them to neglect to review habits of life, clothing, food, and domestic arrangement, which, though they may be in some respects unhealthy, are almost second nature. They are practically hereditary, having come down very often through generations in the family and the race.

There is, therefore, no exaggeration in claiming that domestic sanitary reform is a prerequisite to the lasting duration of any other, — without it national hygiene is the labor of Sisyphus, — a never-ending, constantly-recurring effort.

Legislation, the favorite reliance of many reforms, cannot help us much here, not only because so much of climatic unhealthfulness is beyond its reach, but chiefly because a law must be the reflex of popular sentiment to be much more than a dead letter.

Even in the most evident necessity, as of vaccination in the presence of small-pox, how often does family ignorance, or fear, render the attempt to protect so nearly a failure as to be a practical demonstration of this truth. It is evidence, too, of the dependence of the most essential sanitary work upon the intelligent coöperation of those by whom, or for whom, it is proposed to be done.

The leading question for us then in the matter of education is how to reach the family most directly and effectually with sanitary truth?

There are three ways: —

1st. The profession of medicine, represented by the family physician.

2d. The public press.

3d. The common school.

I name them in the order of their relative value, supposing each to be good of its class.

The physician is put in the first rank because it is his by virtue of his profession. His duty is to be the doctor, that is, the teacher, of the people of his cure in sanitary things.

Never since the time of Hippocrates, who first taught hygiene, has this department of medicine afforded better opportunity for work, or given more promise of abundant harvest than now.

It must be admitted that the physicians are somewhat lacking here, — partly because of carelessness, perhaps, but chiefly because people so fully occupy his time and energies in the treatment of existing disease that he is, almost per force, distracted from the higher duty of preventing its occurrence at all.

The duty of medical men, especially the country practitioner, in this direction are so important that I hope this association may attempt to encourage and aid them to its better performance. There are many physicians who should be encouraged to go outside private practice to teach sanitary science, — in the newspapers or before the lyceum, — where they can easily find abundant opportunity to do real missionary work.

The next most effectual method of reaching the family, and one which has a field and means peculiarly its own, is the public press. It is already in use, all over this land, in its remotest rural district as in the city, to an extent few seem to realize, for the diffusion of so-called knowledge. Much of it is not only subversive of morals and of family life, but of personal health as well.

This statement is increasingly true among that portion of our population whose children attend the common schools. It is done by the free distribution of suggestive circulars and the subsequent sale of books relating to subjects which, if not discussed with scientific and Christian reserve, should not be discussed at all.

To the newspaper and periodical press, except as relates to advertisements in some of them, this remark does not apply. On the contrary they are, as a rule, devoting more and more attention to the appreciative discussion of sanitary questions, and are helping constantly to increase popular knowledge of hygiene. The popular demand for such information is increasing, and for this reason the newspaper and periodical press is freely open to any one having anything of value to offer. The plain duty then of health boards health officers, and medical men is to avail themselves of the opportunity. But sanitary science is worthy of more complete presentation than can be made in such ways, and no means is so available for this purpose as the preparation and distribution of plain and simple tracts or manuals. The English are in advance of us in this way. I call the attention of the association to an admirable series of such little books, written by Parkes and others, and published by the Society for Promoting Christian Knowledge of London. They are sold for a nominal price, they are thoroughly practical, easily understood by every one, and should have the widest circulation. Some of them would make capital text-books for common, and even higher, school use.

The last agency which we have selected is the common school. The difficulties here are apparent from what has already been said. They are the ignorance and indifference of the average school board, and the lack of knowledge by the teacher. Then, too, the time of the pupils in common schools is so fully occupied now by the studies thought to be necessary, that there is little opportunity for another one.

The school board can be reached through the family and educated popular opinion in the way already pointed out, and so can the teacher; but there should be provided for the teacher practical instruction in hygiene in the normal schools and teachers' institutes. This has already been attempted, but only by the use of a text-book, and that without the guidance of a competent, living instructor.

No one can take the place of the physician in such instruction. His own experience affords abundant illustration of practical sanitary truth and methods. He only can impress with the vividness of actual knowledge the dangers to health and their remedy upon the teacher's mind.

In this way common school teachers can be sent to their work prepared to use hygiene in the conduct of their schools, and to enforce its practice upon pupils when opportunity offers. Even without a text-book or formal instruction they may use almost every fact or experience of school life to fix a principle or illustrate a method.

Texts for profitable instruction are all around them. Air, water, the school-house and its furniture, its heating and ventilation, the accident or sickness of pupils; the use of the eye, the voice, the sense of touch, etc. Out of doors (where in summer the school ought chiefly to be), are the earth and its products, the sky and its clouds, sunshine and storms. There is no end to the variety and interest which common observation and tact can give to such instruction.

I am at a loss to suggest a good text-book on hygiene, other than those mentioned. It is not physiology or anatomy that we want. They have their place, but it is subservient to the real object how to live long and healthfully.

What is needed is rather a sanitary creed, short, concise, and practical. In the case of health, as in the morals, children cannot always be made to understand why it is right to do one thing, and wrong to do another. Authority must often take the place of proof, leaving for later years the evidence which only a more mature judgment can appreciate. Illustrative fact or incident are better than logic for them. Even with the best text-book the real work is the teacher's. Unless he or she is alive to the importance of the subject, and making some effort at personal use of it, and so able to teach by example, as by precept, to enforce the last by the first, not much enduring impress on scholars' minds will be made.

After all, one cannot help wishing for the time when the mothers of families will take this duty on themselves, caring for the physical welfare of little ones as earnestly as they do for their moral and religious health. They are the best teachers, and could do more than any one to secure for their children the priceless boon of a sound physical basis for the development of all after life.

There are other aspects of this vital question of health for the people which press upon one who attempts to study it. I have not time or space for their development here. My aim has been as much to suggest thought as to elaborate it. I am sure we cannot feel too deeply the vast importance of the subject of this paper as an element of public health.

I shall have accomplished my purpose if I have shown the importance of the use of the family, the home, and the common school, as helpers in the work of sanitary reform in the nation.

Intelligent popular study and practical use of private hygiene in the family is the true foundation of public hygiene. With it great advance will be not only possible but imperative. Without it progress will be slow and doubtful, and even what may be gained will be in constant danger of disuse and loss.

XII.

A REVIEW OF THE PRESENT STATE OF EXACT KNOWLEDGE REGARDING THE CAUSATION OF EPIDEMIC INFECTIOUS DISEASES.

A DISCOURSE BEFORE THE ASSOCIATION AT ITS CHICAGO MEETING, SEPTEMBER 26, 1877.

By HENRY M. LYMAN, M. D.,
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BEFORE proceeding to a consideration of some of the diseases which are most destructive to the human race, I desire to fix your attention for a few minutes upon the phenomena which are produced by the bite of a poisonous serpent.

The noxious venom is the normal secretion of healthy glands situated in the mouth of a reptile. It is there, by the cells of the gland, elaborated from the elements which are furnished in the blood of the animal, just as ptyalin is formed by the cells of the salivary glands out of identical protoplasmic elements. Like pepsin and the allied ferments which originate along the course of the alimentary canal, it is powerless to initiate change in the living tissues of the animal by which it is produced; but let it find access to the tissues of a creature of another species, and at once it begins to modify their functions. I will not detain you with a recital of the symptoms of snake-poisoning; I desire only to fix your attention upon the essential nature of the process which is thus originated. The venom of a rattlesnake, for example, has been discharged into the areolar tissue of a human body. It is a substance endowed with great energy. In other words, it is composed of organic matter of which the molecules are capable of disengaging a great amount of motion. This is proved by the burning sensations, numbness, and other nervous phenomena which immediately follow the application of the poison to the flesh. That it is circulated by the current of the blood, so that its effects pervade the entire body, is proved by the generalization of the symptoms, and by the fact that the blood, after its contamination, may serve to excite all the phenomena of poisoning, if it be injected into the bodies of other animals. That it does not multiply itself after ejection from the poison-duct, is shown by the fact that the severity of the symptoms is proportioned to the quantity of the venom actually discharged by the glands of the reptile; and by the fact that, while the blood in which it is dissolved becomes poisonous to other animals, the actual transfusion of a considerable portion of that blood may be needed in order to convey enough of the poison to produce a decisive effect. An effort has been made to show that the venom is composed of "germinal matter," which reproduces itself rapidly within the bodies of inoculated animals; but the facts just emphasized, and the use of the microscope, identifying the supposed germinal vesicles with simple colorless corpuscles,[1] prove that the venom is closely related in its origin, its mode of action, and its lack of reproductive power, to ptyalin, pepsin, pancreatin, and the other digestive ferments.

Closely resembling, and yet widely differing from the results of snake-poisoning, are the phenomena occasioned by the bite of a mad dog. Here we have a virus instead of the normal product of healthy secreting cells. It is still the elaborated outcome of cells, but they are diseased cells. Their product is endowed with energies which ally it with the septic products of organic decomposition rather than with the highly organized digestive ferments. Like such ferments, snake-poison lacks the power of self-multiplication. Like all septic products, the virus of rabies reproduces itself in the tissues with which it may be placed in contact. It seems in this respect to occupy a position intermediate between fully vitalized organic substances and those which have ceased to live, and are in process of resolution into their inorganic constituents. The distinctive attribute of matter in such a condition is its power of reducing healthy living tissues to an identical condition. This really constitutes the essential difference between a poison and an infectious virus. Hydrocyanic acid, nettle juice, and the venom of a copper-head, may be accepted as types of the poisons; while the fluids of a dissecting-room, the lymph of a vaccine vesicle, and the exhalations of measles, furnish illustrations of an infectious substance.

A poison, therefore, is dangerous and energetic in exact proportion to its quantity; while an infection is to be estimated rather by its quality than by its quantity.

Let us now consider the process of infection with the saliva of a rabid animal. In the first place, the effect is not immediate, as it would be after the infliction of a wound by a venomous insect or reptile. There is a period of incubation, during which the bitten animal displays no morbid phenomena. But the infective matter is not inactive. The minute speck, which was introduced through an almost imperceptible abrasure, communicates its peculiar modes of motion to the molecules of the contiguous tissues. They, like all other moving bodies, tend to impart their motion to another series of molecules; and thus the process of infection widens its sphere until the whole body is involved. The fluids of the body become the vehicles of the infection which is elaborated by the cells, and thus the disease may be perpetuated indefinitely. Direct inoculation has often subjected healthy animals to the disease, and the failure of the operation is undoubtedly to be ascribed to the same cause that occasions failure in cognate experiments with vaccine virus. Mere inoculation with the blood of a vacciniferous animal often fails to communicate the disease, while the actual transfusion of its blood will convey the infectious matter in quantity sufficient to overpower the vital resistance of the healthy tissues, and to reproduce the morbid phenomena. It is also probable that in this fact we have

[1] Ziemssen's *Cyclopædia*, vol. iii., p. 548.

the key to the frequent immunity which follows the bite of a mad dog. A sufficient quantity of the virus is not introduced to overcome the vital forces which resist intrusive energies and maintain the health of the economy, so that an infective focus is not established.

In all these particulars there is an exact parallel between the mode of origin and the manner of action of vaccine virus and of canine virus. Both are the product of morbid cells; both are inoculable; both are capable of self-multiplication and of indefinite propagation. We must not, however, lose sight of the fact that the multiplication and propagation of these infectious substances is not through the conjugation or the fission of cellular organisms. They multiply through their action upon normal cells, converting those structures into seats of disease whose products are no longer the ordinary healthy secretions of the body, but are substances endowed with the power of exciting a specific morbid process in all kindred animal tissues to which they may be applied. It is a multiplication of morbid *function* rather than a generation of new growths of protoplasm. A certain cyclical tendency is, however, to be noted in these processes, in obedience to which we at last discover an actual reproduction of the original matter of infection at a point corresponding to the original source of infection. For example, in hydrophobia the infecting process which has been excited by inoculation at length reaches the salivary glands, and they secrete a poisonous fluid identical with the original virus. The introduction, also, of a particle of vaccine virus into the arm of a healthy infant, after contaminating its entire structure, results finally in the formation of a vesicle in which may be discovered a virus identical with the contents of the original pock. In seeking for the primordial source of hydrophobia it is, therefore, necessary to study the salivary disorders of canine animals. Were this done as carefully as the vaccine disease has been studied, we might hope to ascertain the initial causes which produce hydrophobia.

We have now considered the manner in which the body of an animal may be overpowered by a poison or by an infection derived from an external source. Let me ask your attention to a class of diseases in which the infecting source may exist either without or within the body of the patient. Septicæmia, diffuse cellulitis, and erysipelas are familiar examples of infectious diseases which may thus originate. In the dissecting-room a medical student punctures his finger with the point of a scalpel. You know the consequence — a dangerous disorder, which may even result in his death. It is clear that the decomposing fluids of the dead body are dangerous. The wound which they have contaminated becomes inflamed; the inflammation leaps all bounds, and involves perhaps the entire body. It is a process analogous to that which follows the bite of a serpent. But these diffuse and erysipelatous inflammations are not always thus produced. Under the influence of bad air, bad water, bad food, and bad accommodation, the nutrition of the body may become depressed. The cellular elements become overloaded with effete substances, which are not oxidized to a degree that renders them diffusible and easily removable. This, of course, hinders that introduction of fresh nutriment, and that constant disengagement of motion which is characteristic of vigorous health. The equilibrium of such an organization is not responsive to forces which operate from the interior of the cell; it is abnormally disturbed by forces acting from without the cell. This state of impeded nutrition constitutes what is called a *predisposition*. If, now, a person thus predisposed be subjected to any form of external violence — a slight abrasion, for instance — an unhealthy inflammation is established at the point of injury. The products of this inflammation act the part which is played by the saliva of a mad dog, or by a particle of vaccine virus; they *infect* the contiguous tissues, which in turn pass on the infectious energy, until every cell in the body has become involved. It is a conflict in each cell between the vital forces which should maintain the normal modes of motion among the molecules and the incident physical forces which tend to the production of disintegration and disease. It is a process analogous to the order of sequences which follow the bite of a rabid animal; but it differs by the fact that the infectious matter is produced at home instead of being imported from abroad. There are, sometimes, also, cases in which the infection thus produced displays a virulent energy which will not admit of its restriction within a single human body. This is usually true when predisposing causes have acted with great severity upon a whole community. The very neighborhood of such a patient may then become dangerous, and even his breath may be the vehicle of infection. The disease is then likely to diffuse itself as a veritable epidemic. A most instructive example of this autogenetic origin and propagation of erysipelatous disease is related by Dr. Carpenter, from the experience of Mr. Huxley "when serving as assistant-surgeon on board H. M. S. *Rattlesnake*, which had been engaged on a surveying voyage about New Guinea and Australia. The crew seem to have acquired a predisposition to disease by long confinement, exposure to tropical sunshine, unwholesome food, and other unfavorable influences; but no decided malady had shown itself among them, until one of them, after slightly wounding his hand with a beef-bone, had suppuration of the axillary lymphatic glands, with which typhoid symptoms and delirium were associated, and which proved fatal. A few days after his death, the sailor who washed his clothes had similar symptoms of disease in the axilla; and for four or five months he suffered with sloughing of portions of the cellular tissue of the axilla, arm, and trunk of the same side. Near the same time, a third sailor had diffuse inflammation and sloughing in the axilla; and after this the disease ran in various forms through the ship's company, between thirty and forty of whom were sometimes on the sick-list at once. Some had diffuse cellular inflammation; some had inflammation of the lymphatic glands of the head, axilla, and lower extremities; one had severe idiopathic erysipelas of the head and neck; another had phlegmonous erysipelas of the hand and arm after an accidental wound; others had low fever with or without enlargement of glands. Finally, the disease took the form of mumps, which affected almost everybody on board. The epidemic lasted from May to July (the winter of the southern hemisphere), the ship being at sea during the whole time." [1]

[1] Carpenter's *Physiology*, p. 291. Eighth English edition.

A similar predisposition to infective processes not unfrequently manifests itself in families or in communities, as, for example, in the epidemics of erysipelas which have been recorded in our own country. We may, also, consult with profit an interesting series of cases related by Dr. George Hunter, of Scotland, and republished in the "Chicago Medical Journal," p. 369, April, 1877. It is the occurrence of this predisposition which causes certain puerperal women to exhibit the phenomena of auto-infection. The uterine wound becomes the centre of an infecting process which invades the whole body in a manner quite analogous to the propagation of a vaccine or a hydrophobic infection. Sometimes, though rarely, the process may even extend itself to the epithelial covering of the hand of an attending physician or midwife. This produces a non-eruptive epithelial disease which does not seriously disturb the general health; but, while it persists, no amount of washing will avail to remove the infectious matter which is continually formed by the epithelium; and the slighest contact is liable to communicate the disease to uterine or vaginal tissues, where it excites the same diffuse cellulitis or other puerperal inflammation which first brought it forth. A similar epithelial disease of the hands is occasionally caused by prolonged contact with the putrescent fluids of the dissecting room; and it is liable to be attended with similar results, if the sufferer allows himself to engage in obstetrical practice.

We are now in a position to estimate at their true value the researches which have been made regarding the formation of tubercle. The results of experimental inoculation with tubercle are familiar to all; but the full significance of those experiments has not been so generally perceived. The following summary will exhibit the present state of our knowledge concerning this topic. When upon the surface of certain animals a purulent inflammation is excited by inoculation with tubercular matter or otherwise, the animals perish with tubercular consumption. In like manner, when an inflammation is established upon the surface of certain human beings, they too are liable to become tubercular. The surface may be cutaneous, oral, pulmonary, or intestinal. The class of persons thus liable constitute the so-called *scrofulous class*. The several stages of the process of tubercularization present a remarkable analogy to the process of infection with the virus of rabies. The infecting virus in the one case is elaborated by the salivary gland cells of a dog; in the other it is furnished by the inflamed tissues of the skin or of the mucous membrane of the individual. Formed, probably, outside of the blood-vessels, the infection finds its way through the lymphatic channels, and is arrested by the lymphatic glands. The infected glands enlarge; they become stuffed with caseous products of degeneration; and this caseous matter may, in its turn, prove itself an infectant which shall occasion the most extensive dissemination of tubercular foci. Thus may an obstinate cutaneous eruption upon the scalp result in caseation of the cervical glands, and in tubercular meningitis. Thus may a bronchitis sow the seeds of pulmonary consumption; thus may a chronic infantile diarrhœa terminate in general tuberculosis. Obviously, therefore, the best means of preventing consumption will proceed from an effort to eradicate the scrofulous diathesis. Since this implies attention to hygiene, and necessitates a sufficiency of good food, pure water, clear air, warm clothing, and sound morality, I fear that scrofula will linger long in our communities.

Measles and scarlatina form a group of diseases which often prove themselves destructive to human life. We know very well how they prevail sporadically at certain times; and, again, as a pandemic pestilence, how they ravage vast territories. Their variable severity is also conspicuous; sometimes occurring as the most trifling of ailments, and at other times presenting the most frightful mortality. Their ordinary mode of propagation by contagion is generally accepted. But what was the original source of their infection? At this point observation fails us, and I might very properly pass to the consideration of another topic, were it not for the fact that this seems a convenient place for a few words concerning the general subject of the origin of infectious diseases. We ordinarily see them communicated directly from one person to another; consequently, the majority of authors are content to refer all such cases to a direct transmission of infecting matters from one generation of patients to another. Really, however, this mode of accounting for the origin of infectious diseases is merely the last resort of an idle mind. We can never thus account for the *first case* of such disease — of scarlet fever, let us say. Nor can we logically argue from ordinary consequences to extraordinary causes. When, moreover, we carefully examine the facts in our possession, we cannot legitimately avoid the conclusion that the mode of origin of particular cases of infectious disease is not always the same. Scarlet fever does not prevail in all parts of the world. It has never been known in Japan; it only occurs in tropical countries when introduced from without; and it soon becomes extinct in those torrid climates. These facts indicate that it must have first appeared in some particular locality outside of the tropics, in Asia, or Europe, and that its causation must have been dependent upon the reaction between the human organism and the physical forces which impinge upon it. Since it is the throat which first exhibits the disease, it is more than probable that in scarlet fever we have an inflammation of the fauces which, in consequence either of a bodily predisposition, or of a particular conjunction of external incident forces, or of both these causes acting in unison, tends to infect the entire body of the patient; just as we have seen that a superficial inflammation may infect a scrofulous subject, and result in tubercular infiltration. The whole course of scarlet fever, from the initial chill to the close of desquamation, points to a progressive infection. This, however, does not account for the contagious quality of the disease. But, if we reflect upon the phenomena of erysipelas and of diffuse cellulitis, as narrated by Huxley and by Hunter in the cases to which I have referred, we shall discover that *communicability is not an essential quality in any disease; it is a purely accidental phenomenon.* Witness the cases already related; witness the variable facility with which measles, scarlatina, whooping cough, and typhoid fever, spread at different times through a community. Witness the restriction of cholera within narrow limits one year, and its universal diffusion another season. Witness the history of pneumonia — mild and sporadic, as we know the disease, but constituting, in conjunction with the plague, that most terribly infectious epidemic, the "Black Death." Witness, also, dysentery, — in our climate an occasional and comparatively harmless malady; but often prevailing in tropical countries as a dangerously communicable disease.

If now we can recognize as a truth the proposition that *the infectious quality of a morbid process is rather an accidental characteristic than an essential element*, we shall find it easy to explain all those anomalies which, in the light of the current theories, are utterly unintelligible. How often we are called to observe a solitary case of scarlet fever, occurring in the midst of a large family of children who have never contracted the disease? The little patient traverses every stage of the malady, but not another case presents itself before the community. What is the reason? One says, he cannot tell. Another entertains the hypothesis that all the children in such a family have experienced the disease in a latent form. But a distemper which exhibits no symptom is as good as non-existent, and may be left out of the question. Why is it not better to accept the natural explanation that, in such instances, the disease lacks its usual infectious energy; or, if we would speak with scientific precision, to admit that the molecules of infectious matter do not move with intensity sufficient to overpower the normal modes of motion in healthy tissues with which they are brought in contact?

The history of typhoid fever presents additional illustrations of the accuracy of this doctrine. Sporadic cases of the fever are of continual occurrence. Fever patients are admitted to general hospitals, and are placed indiscriminately among the ordinary patients, yet the disease is not communicated to a single individual. A nurse, who has never had the fever, may for years have charge of a fever ward, sleeping every night within a few feet of the patients, and experiencing no ill effect until the disease assumes a communicable and epidemic form. Only then does this nurse succumb; and almost simultaneously the attending physicians contract a disease which they have previously handled with impunity. We have all been familiar with such examples. In like manner, when cholera was brought to our city, in 1849, and in 1866, it raged with terrible virulence; but in 1867 the few cases which occurred seemed to exhibit no infective energy.

In 1866 the admission of a single cholera victim was immediately followed by a rapid infection and loss of life among the inmates of the Cook County Hospital; but in 1873, when an entire family of cholera patients was introduced into the same hospital, though one or more of them died in the general wards, and though not the slightest precautionary measures in the way of disinfection or isolation were attempted, not a single individual contracted the disease.

Many other examples of this sort might be produced, did time allow. It seems to me impossible for any one who is not blinded by a preconceived theory to review the facts of his own experience, or, better yet, to study the history of epidemic diseases, without being impressed with the conviction that infection or contagion is an accidental quality impressed upon the contents of diseased cells by a concurrence of forces chiefly operating from without the organic structure in such a way as to increase the potential motion of their molecules; just as a particle of iron may be heated till it can burn and sear like fire, and yet it is nothing but iron to the very last. Consequently, I do not see how any one can logically insist upon the uniform preëxistence and operation of a *specific* organic virus or miasm as the only cause of every case of a disease like typhoid fever. It is the uniformity of the sequence observed in small-pox that blinds us to the fact that the majority of ailments are even now, at certain times and in certain places, as autogenetic as diffuse cellulitis and mumps have been shown to be. Perhaps, if we could track small-pox to its Chinese cradle, evidence might there be found which would prove its conformity to what I believe is a universal law.

In the mean time, the present state of science requires us to admit for typhoid fever and its congeners three different modes of causation: —

I. *Autogenetic infection*, in certain countries where, at certain seasons of the year, under the operation of various agencies which interfere with health, the cells of the body no longer elaborate their contents in a normal manner, and the whole body becomes the spontaneous seat of a specific febrile movement. This may be called the endogenous form of the fever.

II. *Mediate infection*, by typhoid dejections which have found their way into the soil, and have contaminated the food or the drink of a community. This constitutes the miasmatic variety.

III. *Direct infection*, by contact with the bodies of the sick. This forms the contagious variety, and can only occur when the virulence of the disease has, under peculiarly favoring circumstances, reached its highest expression.

I believe, moreover, if the whole truth were told, we should discover the same three modes of genesis in typhus fever, a distemper which, as it ordinarily prevails in epidemic form, may be regarded as the type of a directly communicable disease. It is usually encountered only in Ireland and in the northern countries of Europe; but from those centres it has, at various times, spread in epidemic form over the greater part of the civilized world. At such epochs there can be no doubt of its directly infectious character. But occasionally it happens, when no epidemic is in progress, that, far from the native home of the disease, a solitary case will present itself without antecedents or infectious quality. Two such cases have occurred under my own observation. The hypothesis that all such cases result from infection by germs which have preserved their vitality for years, though buried in the soil, or exposed to all the extremes of variable heat and moisture, is too absurd to require a formal refutation.

A malady which, though seldom observed in our country, is often experienced in Europe, deserves mention in this place, because of a recent attempt to refer its causation to the growth of a microscopical fungus in the blood. I refer to *recurrent typhus* or *relapsing fever*. This form of fever has always been recognized as an infectious disease; and its autochthonous origin was generally admitted, until 1873, when a spiral, thread-like, microscopical fungus was detected in the blood of patients who were subjected to examination during the periods of invasion and relapse. To the presence of these lowly forms of life was attributed the occurrence of the fever. The plausible hypothesis was at once caught up by the advocates of "the germ theory," and it fairly disturbed the equilibrium of some who really ought to have known better. To enter upon a discussion of the relations of bacteria, and other microscopical parasites, to the animal tissues would consume too much time. It may, however, be accepted as a general law of nature that living forms are only found upon an appropriate soil, and in a climate adapted to their growth. Accordingly, these miscroscopical cryptogams grow as the grass grows — where their nutriment exists. Now we know that such nutriment consists almost wholly of decomposing organic matter. In this connection, therefore, it becomes a very significant fact that these peculiar protomycetes are chiefly discernible *during the periods of invasion and relapse*, when from the very nature of things the blood of the patient must be more than usually charged with the products of organic disintegration. Defervescence and the defecation of the blood are quickly followed by the disappearance of the intruders, just as flies disappear when carrion is removed. The same thing is doubtless true of the bacteria which fill the blood in anthrax, that terrible epizoötic known to western farmers as *milk-sickness*; a distemper which in the form of *malignant pustule* may be communicated to the human species, either by inoculation from the diseased animals, or by eating their flesh, or their milk and its products.

The infectious character of anthrax, even after its transmission to man, has been abundantly shown by many experiments, but all observers are not agreed as the nature of the infection. Pasteur and his school maintain that it is a particular species of bacterium by which the blood of the animal is invaded with fatal results. He relies upon experiments like the following, to prove this assertion: from the blood of a victim of anthrax he separates a quantity of bacteria. He cultivates these bacteria in neutral urine. Filtering the liquid, with the bacteria, which have been all retained upon the filter, he inoculates a healthy animal, and soon witnesses its dissolution with all the symptoms of anthrax. The liquid which traverses the filter is, by inoculation, proved to be utterly harmless. Hence, he concludes that the poison is not a soluble virus, but is inherent in the bacteria themselves — is really a parasitic organism.[1]

On the other hand it is claimed[2] that the peculiar bacteria of anthrax do not appear in the blood until a time considerably later than the initial period of the disease, and that inoculation with such blood at this early date, before the appearance of the parasite, is perfectly effectual; consequently, the cause is a soluble virus. This is the opinion of the Veterinary Faculty at Alfort.

Bollinger and others[3] reply that while it is true that the bacteria of putrefaction only appear at a late period, or after the death of the animal, they are preceded by a crop of the specific bacteria which excite the disease.

Professor Bert, of Paris, has recently subjected the question to his new method of investigation with compressed oxygen. He finds that organized ferments, like the yeast plant, bacteria, etc., are destroyed and rendered

[1] *Le Progress Médical*, July 14, 1877, p. 550.

[2] Loc. cit., p. 511, June 30, 1877.

[3] Ziemssen's *Cyclopædia*, vol. iii.

inert by compressed oxygen and by alcohol. On the contrary, the action of these substances has no effect to diminish the infectious energy of the virus of vaccinia, or of glanders, or of the blood of anthrax from which the bacteria have been separated by filtration. Hence, though assenting to the statement of Pasteur that certain cryptogams are poisonous, he believes that his experiments show that the active cause of anthrax is a soluble virus occupying the blood. Pasteur replies that compressed oxygen cannot destroy the *germs* of bacteria; and that the supposed communication of anthrax by inoculation with blood from which the bacteria have been filtered is a mistake. He asserts that such experiments have been only examples of inoculation with putrescent blood — mere cases of ordinary septicæmia! An exceedingly audacious assumption, to say the very least!

Among these apparently contradictory utterances, what opinion shall we entertain? It seems to me that all contradiction can be avoided if we admit all the observations, and illuminate them with the light of analogy. When Pasteur clears the blood of its parasites, the residuum is still confessedly infectious. When he cultivates the bacteria in a neutral fluid, they retain the infectious energy of the blood from which they were separated, but do not communicate that quality to the new medium in which they float. Now, these micro-phytes multiply by fission and by spores; consequently, each new creature will for an indefinite number of generations partake of the properties of its parent. It appears, then, that the virulent quality of these bacteria is not sufficient to maintain their own energy, and also to contaminate the surrounding medium. Obviously, therefore, the poisonous residue which still infects the blood after the bacteria have been removed must have had some other source than the parasites, which, though flourishing well enough outside of the patient, cannot there elaborate anything which will infect their environment.

Now we know that all the different kinds of virus, and the various digestive ferments, are the products of organized bodies, — to wit, the cells which help to make up the tissues of the animals in which they exist. Consequently, we must believe that a substance which responds in the same way to chemical reagents, and which like them can be separated as a soluble glycerole, must be a kindred substance, and must be the product of organized cells. And since it has been shown that bacteria do not liberate any such substance, the only remaining cells by which it can be produced are the cells of the animal itself. It is a product of morbid cell-action, strictly analagous to the other kinds of virus with which we are familiar. The minute cryptogams which vegetate in the decomposing liquids of such a victim may very naturally become saturated with the virus in which they float, and may thus become carriers of infection when they are removed from the blood. They seem capable of nothing more. There is not a particle of evidence that they originate the infection. The question of the ultimate cause of the disease can only be answered by a study of the reactions which occur between the cellular elements of the lower animals and the various incident forces to which they are subjected. It will then, doubtless, be discovered that under certain peculiar conjunctions of force, some ordinarily harmless and insignificant distemper becomes endowed with an infectious energy which, once awakened, tends, like a new variety of plants, to persist for an indefinite period of time. It is also highly probable that the specific cryptogam, which is always visible in the blood at a particular stage of anthrax, may serve as a positive sign of the existence of anthracoid disease wherever it is discovered, even though the usual infectious quality be not manifested; just as the peculiar micrococcus which exists in the false membranes and in the tissues of diphtheritic patients may also be detected in the products of harmless inflammations to which science has not yet affixed the term *diphtheritic*, for the sole reason, apparently, that, notwithstanding the remarkable degree of difference in the communicability of the malady at different times and places, we have not fully recognized the fact that diphtheria is not always an infectious disease. Upon this point future investigations should be concentrated.

I have thus dwelt at length upon the subject of malignant anthrax because it is a type of the so-called endo-parasitic diseases; and if it can be proved that in one of them the parasite is not the cause, but rather the consequence, of the disease, we thus obtain presumptive evidence that the same thing is true in all the other members of the class. At the same time we need not hesitate to admit that in diphtheria, at least, the cryptogamic vegetation which flourishes with such luxuriance at the expense of the disintegrating tissues of the body may, by its abounding presence, mechanically, if not vitally, interfere with the functions of such structures as the nervous centres, and may thus assist in producing the various sequelæ of the disease.

YELLOW FEVER is, fortunately, one of those formidable diseases with which we in Chicago are unacquainted. But its frequent occurrence in our Ssuthern cities confers upon it the highest importance. Though epidemic in its prevalence, it stands at the opposite pole to such a malady as scarlet fever. One originates at the north; the other at the south. Cold weather favors the spread of one; it stamps out the other. Scarlet fever is propagated by direct infection; yellow fever by indirect communication. Inhale the breath of scarlatina, or inoculate yourself with its fluids, and your whole body will be at once involved without remedy. But you may, ordinarily, eat, drink, and sleep among the victims of yellow fever without the slightest danger, if only their excretions are kept from contact with the earth or other substances which favor their reaction with heat and moisture. We have, then, in yellow fever, no living, infectious matter, separated directly from living tissues; nor have we an organic virus, the product of diseased cells; we have to deal with a miasm, formed by the decomposition of human excreta in contact with organic debris in the presence of moisture at an elevated temperature of the atmosphere. A volatile miasm, thus produced, cannot be a substance capable of multiplying itself in the human body. It is a compound poison, elaborated at some stage of its evolution by certain constituent cells of the human body; but the poisonous quality exists only as a potential form of energy until acted on by heat and moisture and other organic matters outside of the body; just as the various products of the cells concerned with digestion do not reach their full development in the gland-cells where they exist in the form of pepsinogen, of zymogen, and of glycogen. It is only in the act of extrusion from their genetic cells that these substances, by reaction with other fluids of the body, are ripened into their ultimate forms — pepsin, pancreatin, and animal glucose. In like manner, as the digestive ferments, though wonderfully energetic in the transformation of nutriment, are incapable of reproduction and self-multiplication in the contents of the alimentary canal, so the miasms cannot reproduce themselves in the animal organisms which they are so potent to destroy.

And, as the digestive ferments can in heterogeneous food-stuffs induce changes which enable them as peptones, or as glucose, or as emulsified fat, to enter the cells of the body and to reappear as a digestive ferment, — pepsin, pancreatin, or their like, — so a miasm of animal origin is nothing more than an excretion, perfected chiefly through the agency of heat and moisture outside of the body, and thereby qualified to enter the blood and to so change its nutritious constituents that, passing through the cells of the body, they shall emerge in a form better than ever adapted to the production of a perfect miasm. In order, therefore, to account for the origin of the first case of *zoö-miasmatic* disease, we have only to account for the origin of the first human being who invaded the earth.

It is also apparent that the causes of yellow fever and of typhoid fever are nearly related; and what is true of the causation of one is probably true of the other. One is the "filth fever" of the occidental tropics; the other is the "filth fever" of temperate climates. Either one of them may be intruded by artificial transport into countries far from its place of spontaneous origin, but neither one can maintain itself long in an uncongenial clime. Hence the success of quarantine against their invasion of countries where they are non-indigenous. In our northern latitudes we may probably rely upon quarantine alone for protection against yellow fever; but in our Southern States experience shows that the disease is liable to appear without importation at any time when the conditions of heat and moisture and human filth concur in due proportion.[1] Consequently, our Southern brethren can never afford to relax their vigilance in regard to matters of civic hygiene.

One more destructive disease must briefly engage our attention. In CHOLERA we find an enemy worthy to rank with the plague as a destroyer of mankind. There are few of our number who cannot call to mind a most vivid picture of the horrors which attend this pestilence as it devours the earth upon its westward march. No disease has been more carefully observed; about none has more been written and said. Scarcely anything remains concerning which there can be a difference of opinion, save only the question of cause. Is cholera indigenous only at the East? Or may it

[1] It is impossible to study the history of our Southern epidemics of yellow fever without perceiving that men who write under the influence of a preconceived theory are compelled, beyond all measure, to wrest the facts of their observation in order to find in them any support for the hypothesis that the yellow fever of our Southern cities is always imported from abroad.

spontaneously originate in any country where the concurrence of certain conditions may have been secured? These yet seem to be open questions.

If we should restrict our studies to the ordinary historical notices of cholera between the years 1817 and 1866, we might very reasonably conclude that epidemic cholera is of oriental origin alone, and that to the East we must always look when its approach is feared. But the experience which has accumulated during the past ten years will no longer admit an uncompromising maintenance of this belief. The epidemic of cholera, during the years 1866–67–68, in the countries bordering the Rio de la Plata, and the epidemic, or, rather, the cluster of epidemics, in the United States during the year 1873, have thrown great light upon the question of spontaneous development of the disease. The South American epidemic has been described by Dr. E. M. Estrazulas, of Montevideo, in a paper published in the "American Journal of the Medical Sciences," July, 1873, pp. 74–84, and by Dr. José Pereira Rego, president of the Imperial Academy of Medicine in Brazil, who, in 1873, published a volume entitled "A Historical Memoir of the Epidemics of Yellow Fever and Cholera which have occurred in Brazil."

With the history of the North American epidemic, recently published by our own government, you are all familiar. After a careful study of these records, I cannot hesitate to affirm that the evidence in favor of the local origin of these American epidemics is as clear and as convincing to the unprejudiced mind as it is possible for human evidence to become. The history of the South American epidemic places this fact beyond all question for the southern hemisphere; and the facts collected by Dr. McClellan for our own government can by no legitimate possibility be made to prove the exotic origin of the disease which ravaged certain portions of our country in 1873. Yet this effort has been made by Dr. McClellan himself, with what success I shall endeavor to show.

For a number of years cholera had prevailed in different parts of Europe, but had not appeared in the United States, after the epidemics of 1866–67, until the ninth day of February, 1873, when a man, who had been living for two months in New Orleans, sickened and died of cholera. The city was in an unusually filthy condition, and was crowded with victims of the peculiar misfortunes which then pressed upon the South. The hygienic and meteorological conditions over large areas of the Southern States were more than ordinarily unfavorable to health. As a consequence there was everywhere an unusual predisposition to intestinal disorder. In New Orleans cholera became moderately epidemic, reaching its climax with a mortality of one hundred and twenty-five in the month of May, and causing a total mortality of two hundred and fifty-nine during the whole year. From New Orleans the disease seemed to spread in various directions, but without any great prevalence, or any decisive evidence of continuous transmission, excepting in the principal cities of Tennessee, where there was a peculiar concurrence of the causes which always intensify the malignity of the pestilence. During the entire year sporadic cases and little local epidemics were reported at different points along the valley of the Mississippi; but there was no pandemic diffusion of the disease, and it disappeared with the advent of cold weather.

Very naturally, the officials who are charged with the health of seaport cities looked abroad for the origin of the epidemic, but no evidence of the introduction of the disease could be obtained. It was the 10th of September, after the almost universal cessation of the local epidemics, before the disease reached New York from Europe, though a few cases in the month of August had occurred among Russian immigrants after their arrival in Dakota. These cases could have contributed nothing to the epidemic which was at its height in New Orleans during the month of May. In short, the whole question centres upon the New Orleans epidemic; was it autochthonous, or was it of exotic origin?

In favor of an introduction from abroad, Dr. McClellan urges (p. 82) that cholera "reached Hamburg in 1872; and was sent from there to London, Havre, Liverpool, New York, and various other places; probably also to New Orleans." A fine, robust guess! Let us make it No. 1. Now, if thus sent to New Orleans, the disease should, according to every precedent, have appeared among the crews or immigrants, either on shipboard or after their arrival in port. But among the 15,294 persons who thus entered New Orleans between the first of December, 1872, and the last of June, 1873, only one man was ascertained to have suffered with cholera either before or after arrival in the city. This solitary exception sickened in the town of Algiers in May, when the epidemic was at its height (p. 112), and there is not a particle of evidence to show that he did not contract the disease after reaching the Mississippi River.

It was rumored that cholera was prevalent during this time in the West Indies, and inquiries were instituted, "without, however, obtaining any very definite results" (p. 110). The only encouraging item in this connection was the report of the consul at Kingston, Jamaica, that a coolie ship had reached the island, September 23, 1872, and that one of the coolies had died of cholera since the arrival. "It was reported, also, that some sixty of the coolies died on the passage, but the disease was not ascertained by the consul" (p. 110). Just as though coolie-ships and other slave-ships had never before been known to lose large numbers of their over-crowded passengers through the operations of other causes besides cholera! Yet a little later (p. 111), we find it coolly asserted as a "fact" that a "cholera-infected ship" arrived "at Jamaica in September, 1872"! Guess No. 2.

We are also told (p. 110) that two schooners arrived at New Orleans from Jamaica and the adjacent islands, January 21 and January 24, 1873; therefore, cholera was probably imported from the West Indies. Guess No. 3.

We also learn (p. 112) that a ship from Cuba was allowed to pass the quarantine without disinfection, and a week later yellow fever broke out on the vessel; consequently, we must believe that cholera passed the quarantine in a similar way. Guess No. 4.

Then, as for the first fatal case of the epidemic: he was a poor laborer who for months had been wandering around in an unsuccessful search for work. At length, finding employment in the discharge of a general cargo from a Liverpool ship, upon which there had been no sickness (p. 93), on the second day of his engagement, immediately after gorging himself with cabbage (*loc. cit.*), he was taken sick, and died the next day. Here we are desired to infer that his sickness was occasioned by contact with the cargo of a foreign ship (Guess No. 5), and yet not another individual of the crew, or of the nine laborers employed about the vessel, manifested any sign of the disease.

I might thus multiply examples of the manner in which the mere guess of one page is made to act the part of an established fact upon another, but I will forbear. It is very possible that the New Orleans epidemic was due to an exotic cause; but, if so, the big book which Dr. McClellan has put forth comes far short of proving such an hypothesis. In fact, if it may be said to prove anything, it so thoroughly proves the contrary proposition that in future the student who, after careful perusal of the "Narrative of Cholera Epidemic [*sic*] of 1873 in the United States," shall maintain "that the specific poison which produces the disease known as cholera originates *alone* in India" (p. 53), will thereby afford incontrovertible proof of his own lamentable lack of what are sometimes called the logical faculties. Cholera is one of the great filth diseases of warm climates. It has always been sporadic[1] the world over; and if ever the time shall come when the valley of the Mississippi shall be crowded with a population as numerous and as degraded as now defiles the valley of the Ganges, it will to the utmost tax the sanitary science of that day to prevent cholera from becoming both endemic and pandemic throughout these United States.

[1] I am well aware that cholera and cholera morbus, or cholera nostras, are not identical diseases; but I see no reason to doubt their relationship. Cholera morbus seems to be cholera in a benign form, without those qualities of infectious virulence which result from its development upon certain soils, in certain crowded masses of men, under certain conditions of heat and moisture and filth. Asiatic cholera itself soon loses its infectious character when intruded into an uncongenial population; witness the conclusion of an epidemic, or, better, the sporadic cases which occur during the summer following an epidemic. As already remarked, the cases which occurred in Chicago in 1873 appeared to be absolutely non-infectious.

XIII.

AIR AND MOISTURE ON SHIPBOARD.

A FRAGMENT OF APPLIED PHYSIOLOGY.

A PAPER READ AT THE CHICAGO MEETING, SEPTEMBER 26, 1878.

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"Purity of the air is essential to the maintenance of health. If this proposition be not admitted, all reasoning on the matter must cease." — ACKLAND.

"Of all the atmospheric agents, it is the humidity of the air that is most dangerous to the crew." —LÉVY.

IN the report of the Bureau of Equipment and Recruiting for the year 1877, made to the honorable Secretary of the Navy, by its chief, Commodore R. W. Shufeldt, U. S. N., the importance of a more efficient ventilation of ships of war was commented upon and recommendations made towards securing a larger supply of air to the lower decks of our vessels than now obtains.

A chart exhibiting the cubic air-space for each officer and man on board of three vessels taken as the exponents of the various rates in the service was appended to this report.

In this chart the cubic air-space in vessels of the *Swatara* class equals 324 cubic feet for each officer 58 cubic feet for each man, with a complement of 25 officers and 180 men; in those of the *Richmond* class, 273 cubic feet per officer, and 68 cubic feet per man, with a complement of 34 officers and 285 men; in vessels of the *Miantonomoh* rating, 1,158 cubic feet per officer and 81 cubic feet per man, with a complement of 13 officers and 171 men.

These numbers of cubic feet per person are obtained by dividing the total cubic air-space on the lower deck by the complement of officers and men.

The object of a portion of this paper is to exhibit and demonstrate from official data, physiologically considered, the inefficiency as well as the necessity that obtains for a better ventilation.

It is obvious that the number of the crew of a vessel of war is determined by the requirements of the battery and the handling of the ship, and in the instances named limited air-space or overcrowding is an unavoidable consequence.

The Revised Statutes of the United States, paragraph 4252, assign to each passenger on a main or poop deck 16 clear superficial feet; if the decks are 6 feet in the clear, 18 clear superficial feet on lower decks; no passenger to be carried where the decks are less than 6 feet in the clear; and where the decks are 7½ feet or more in the clear, 14 superficial feet is the allowance.

The British merchant-shipping act assigns 72 cubic feet and 12 superficial feet on deck for each person as the minimum space. These measurements we must accept provisionally as a standard.

This unavoidable overcrowding follows its usual law in increased sick and death rates.

How soon the air on these lower decks becomes unfit for the purposes of respiration, and consequently detrimental to health, will be made evident from the following facts: The normal amount of carbon-dioxide existing in the atmosphere is accepted at 4 volumes in 10,000, and the limit of respiratory impurities, as measured by the increased volume of this gas, is stated by the best authorities to be 6 volumes in 10,000. It must be stated here, with the hope that it may be distinctly understood, that carbon-dioxide is used as the *measure* of the impurity of the air, not on account of its own special poisonous action, but because (and I quote the words of Billings) "within certain limits its quantity may be taken as the measure of that of really important impurities, and it is almost the only available test for this purpose."

The observations of Pettenkofer and Voit, Zoch, Donkin, Parkes, De-Chaumont, repeated by the writer, amount to an absolute demonstration of this fact.

Now, in 50 cubic feet of *still* air this limit of impurity is attained by the respiration of a single individual in one minute of time.

It follows, therefore, that in vessels of the *Swatara* class, under like conditions, the limit is arrived at in 1.16 minutes; in those of the *Richmond* class, in 1.36 minutes; and in those of the *Miantonomoh* class, in 1.62 minutes.

These circumstances, however, seldom or ever obtain, for in masses of men engaged in work in confined spaces, with a slow-moving air, conditions existing in a degree on shipboard, the limit of atmospheric impurity is much sooner attained, the amount of CO_2 eliminated from the body by respiration alone being more than doubled in passing from a state of rest to performing work equivalent to walking one mile per hour; that is to say, a man weighing 160 pounds, *at rest*, expires per hour .716 of a cubic foot of carbon-dioxide; walking one mile per hour, 1.446 cubic feet; walking two miles per hour, 2.53 cubic feet; and should the work done be equal to walking three miles per hour, the most useful rate of work, considering the element of time, 3.275 cubic feet of carbon-dioxide are expired.

As a general rule, it may be stated that about 8 cubic inches of CO_2 are given off per hour for each pound avoirdupois weight of the individual when at rest.

As most of our cruising stations are within climates having tropical characteristics, it must be stated here that the effect of increased temperature is to diminish the exhalation of CO_2 from the lungs. The importance of this physiological fact will be seen presently.

The ratio of the inspired air is increased under the circumstances of work.

With these facts, the limit of atmospheric impurity in the vessels cited as examples is attained in less than one minute of time, and it follows as a consequence that on their berth-decks there is not a cubic foot of air normal in quantity at any one instant from the time they are put in until the going out of commission, and this notwithstanding the law of diffusion, upon which their ventilation in a great degree depends.

In the statement first made, the amount of carbon-dioxide resulting from the combustion of fuel or from lights, etc., is excluded; that from the respiratory and cutaneous systems being alone considered.

As demonstrating the varying amounts of this gaseous impurity in the air of the vessels of the navy, I have to call attention to the recorded observations now in the Bureau of Medicine and Surgery, whose accuracy is established over the signatures of the various medical officers observing.

Thus on the berth-deck of the *Powhatan*, while at Norfolk and New York during the months of April, May, and June, the amount of carbon-dioxide ranged from 11.8 to 19.6 volumes per 10,000, the observations being made generally about 11 P. M. No registration on this vessel ever reached the normal.

On the *Swatara*, one of the vessels cited as an example, for the same period, at sea and in port, the range was from 15.03 to 26.62 per 10,000 volumes, and no registration ever approached the normal.

On the *Ossipee* the range was from 14 to 18 volumes per 10,000. The *Saint Louis*, *Franklin*, *Minnesota*, *Alaska*, *Plymouth*, *Colorado*, etc., all present frequent observations, in some near and in all exceeding the limit.

The highest amount of carbon-dioxide recorded gives 39.1 volumes per 10,000, an amount exceeding those found by Rattray and Hayne.

Considering these recorded results in excess of the limit as the measure of the organic impurities in the atmosphere, the remarks of Simon are not inappropriate as describing the condition of the air on the berth-decks of some of our vessels: "The foulness of the air due to the non-removal of the volatile refuse of the human body is as entirely within the physiologist's definition of filth, and as truly a nuisance within the scope of sanitary law, as the non-removal of solid or liquid refuse."

It seems hardly necessary to repeat that pure air is the absolute constant requirement of health and life.

Impure air and overcrowding lower the tone of vitality, abridge life, and favor the spread of zymotic diseases. They are the parents of wasting lung-disorders and of scrofula, and give to their sickly children in the future the inheritance of unproductive labor with its accompanying poverty and crime. They shorten the life of the sailor, and they must be added to those causes suggested by Brassey and Forbes of the decline of the British and American seamen; for this skilled labor, this art and mystery of a mariner, has begun to be considered as in a decay.

The great sick-rates and consequent lessened average duration of life of these selected men of the sea are mainly dependent upon impure air, overcrowding, and humidity. Steam has demanded its tribute in these directions also, as well as the tardy footsteps of discipline in the advancement of sociology.

Of the diseases produced or aggravated by impure air the record increases steadily. All the zymotic diseases, as has been stated, are included in the list, but more particularly are those affections of the pulmonary tissues described as wasting lung-disease or grouped as cases of phthisis pulmonalis.

It is hardly necessary to state that typhus has a synonym in ship-fever, or to recall that its origin and propagation and fatality alike are dependent upon filthy air from overcrowding.

The observations of Rattray, Muir, Blake, MacCormac, Bowditch, Welch, and others have made this evident.

Carmichael (1810) has shown the connection between impure air and scrofula; Parent du Châtelet, that venereal affections are aggravated by impure air; Chadwick, that impure air is a factor in producing habits of intemperance; and I have heard it stated that an eminent captain in our service has observed that most of the quarrels arising on shipboard occur in the morning watches, when the men turn out from their stuffy, air-poisoned decks, thus exhibiting the toxic effect of impure air in a lowered *morale* from depressed cerebration. Air — fresh air — its necessity is the constant iteration of every sanitary observer. It is the essential of life — more necessary than food or water; a man may go days without either, but not five minutes without air.

Accepting the overcrowding and limited air-space as unavoidable, the condition of imperfect ventilation resulting therefrom has been sought to be remedied by the plan proposed in the report of a board convened by order of the honorable Secretary of the Navy, composed of Commander J. R. Bartlett, Chief-Engineer D. Smith, Naval-Constructor F. L. Fernald, and the writer. This report was made in May, 1878, was approved by the department, and referred to the Bureaus of Construction and Steam-Engineering, respectively.

The plan proposed in this report is susceptible of alteration and adaptation to vessels of any class or size. It is simply a modified form of the Napier system of ventilation, having its basis in the plainest application of the statics and dynamics of the air.

It answers the essential conditions called for in all ventilation — the maintenance of the air which fills the necessary cubic space allotted at such a degree of purity (*i. e.*, normal external air) as to keep it free from danger to the health of those who habitually breathe it.

Thus much briefly for the air in its constitution as affecting the health of seamen.

In a much greater degree is *dryness* of the air an *essential* requirement for the health of the sailor.

The amount of CO_2 being taken as the measure of aerial impurity, it has been observed by Angus Smith that its volume is increased in *moist* air. Lehmann says, "The weight of carbonic acid excreted in moist air greatly exceeds that eliminated in a dry atmosphere." It has already been observed that the effect of an increased temperature is to diminish the exhalation of CO_2 from the lungs. Now, the influence of moisture is so great that at high temperatures it neutralizes the effect of such temperature in diminishing the elimination of CO_2, which under such circumstances is retained in the system. Again, as a general rule, the expired air is saturated with moisture, so that when the temperature of the air comes to be the same as the temperature of the body and saturated, no exhalation of aqueous vapor from the skin and lungs is possible; and there is also retained, from that fact, within the body, the excreta from these organs. It is evident that life cannot be prolonged in such an air at a temperature between 90° and 100° F.

With a temperature above 80° air of excessive humidity is injurious, and yet in tropical climates such humidity is sought for by the constant wetting of the decks. The natural humidity of the air on decks at sea, or anywhere else, should never be supplemented by artificial means to render it saturated.

The writer is of the opinion, from observations of his own, that the aqueous vapor in the air is the solvent and carrier of the CO_2, as well as the vehicle for organic matter; and he is led to believe that in determining the purity of the air by CO_2, the relative humidity at the time the observation is made should always be associated. By such grouping the value of this test is much increased, and he hazards the suggestion that it is the want of such connection which has led to the few discordant results by this method of air examination.

The atmospheric observations before referred to, as well as those of the writer, abundantly confirm the fact of the excessive humidity of the air on shipboard. In these observations the relative humidity of the open air on the spar-deck has been assumed as the *unavoidable* as well as the standard of comparison with the relative humidity of the other decks.

The excess over such standard, when it occurs, may be considered as the preventable humidity. It is not an unfrequent occurrence on dry ships, and indeed it must be considered characteristic of them, to find the relative humidity on the inclosed decks less than that of the open air. It is well to remember in all these observations the physical law that the capacity of the air for moisture increases in a geometrical ratio with its temperature, and that for every 27° F. rise in temperature the capacity of the air for moisture is doubled; and also that air is dry or moist, not in proportion to the amount of water it contains, but in proportion as it is more or less removed from saturation. As examples of the relative humidity of the air on shipboard, without any relation to the other associated physical phenomena, the following are presented:—

Powhatan.—Average for June, 1878:

	Relative humidity.
Spar-deck	89
Berth-deck	97

The spar-deck was wet twenty-eight and the berth-deck nine times in the thirty days.

Swatara. — Average for June, 1878:

	Relative humidity.
Spar-deck	75
Berth-deck	79

The spar-deck was washed two and the berth-deck seven times in the month.

These registrations can readily be supplemented for other months and for other vessels.

Through the favor of Assistant Surgeon J. A. Tanner, Jr., U. S. N., the writer has been furnished with a copy of the observations made on board the tug *Mayflower* during part of August and September of the present year, from which the following abstract is made: "The spar-deck" of this vessel "is washed down regularly every morning. The berth-deck and steerage are coated with shellac and regularly swabbed."

Deck.	Hours.					
	10 A. M.		4 P. M.		10 P. M.	
	Temperature.	Relative humidity.	Temperature.	Relative humidity.	Temperature.	Relative humidity.
Spar	21	82	22	76	21	80
Berth	23	79	23	78	23	79

Temperature in Centigrade. Relative humidity, saturation = 100.

Now, the amount of aqueous vapor given off from the lungs and skin varies in a person at *rest* and under certain conditions, but may be assumed as an average from 30 to 32 ounces per diem, or from 550 to 584 grains per hour, enough to saturate from 90 to 100 cubic feet of air; at *work*, about 68 ounces, or 1,240 grains per hour, enough to saturate 200 cubic feet of air at the normal temperature and pressure of 62° F., 30 inches barometer.

The number of heat units required to evaporate this amount of water belongs to the subject of the temperature of the air and the body. These quantities, it will be perceived, are sufficient — considering the crews and their allotted air-space in the vessels cited — to saturate with watery vapor, carrying decomposing organic matter, in all that space, without resort to any other means.

The excessive humidity of the air on the lower decks has its origin almost entirely in the daily water-soaking routine which exists in the service, and to which the decks are subjected.

If this routine washing, holy-stoning, wiping, clamping, scrubbing, etc., is meant for cleanliness, an obvious inference therefrom would disrate the Augean stables from their billets as the preëminent examples of filth, and our vessels would be promoted to that unenvied rating.

If it is not meant for cleanliness, then, in the light of modern scientific research, it is the ruthless and barbarous wielding of a potent disease-producing weapon against the lives of the unoffending and powerless.

The daily routine of vessels in service furnishes ample evidence that the decks are constantly saturated. The following copies of the routine, so far as relates to the wetting of decks, are made from original written or printed documents : —

Monday. — Scrub off all decks with sand.

Tuesday. — Holy-stone all decks.

Wednesday. — Scrub off decks.

Thursday. — Scrub decks with sand; holy-stone forward and after passage.

Friday. — Scrub decks without sand.

Saturday. — Holy-stone all decks.

Sunday. — Wash off all decks.

U. S. SHIP TENNESSEE.

Again : —

	SUMMER.	WINTER.
Monday.	Scrub decks, etc., with sand.	Scrub decks, etc.
Tuesday.	Scrub spar-deck without sand.	Scrub spar-deck.
Wednesday.	Scrub decks, etc., without sand.	Scrub decks, etc.
Thursday.	Scrub spar-deck without sand.	Scrub spar-deck.
Friday.	Scrub decks with sand.	Scrub decks, etc.
Saturday.	Holy-stone deck, etc.	Holy-stone decks.
Sunday.	Scrub decks without sand.	Scrub decks.

U. S. SHIP MINNESOTA.

Again : —

Monday. — Scrub decks.

Tuesday. — Scrub decks without sand.

Wednesday. — Holy-stone decks.

Thursday. — Scrub spar-deck without sand.

Friday. — Scrub decks with sand.

Saturday. — Holy-stone decks.

Sunday. — Scrub decks without sand.

The above outline is given, subject to the approval of the commanding officer. [New W. Q. & Str. bills printed.]

Or the following summaries from official papers : —

Wyoming. — August : Spar-deck wet 4, berth-deck 31, times.

Ossipee. — December : Spar-deck every morning when not raining, berth-deck 6 times.

Enterprise. — June : Spar-deck wet 30, berth-deck 10, times.

Plymouth. — Spar-deck wet 26, berth-deck 6, times.

Saint Louis. — Spar-deck wet 30, berth-deck 4, times.

And in one first-rate during the month of June all decks are reported dry on two occasions.

There appears, therefore, a capriciousness in this manner which should not exist.

In some instances that have come to the knowledge of the writer this wetting of the decks has been delegated to the petty officers of the ship, and has been determined upon by some oracular Bunsby, whose opinions are founded upon the way they used to do in those "good old times" to which he so fondly reverts and in which he so implicitly believes.

The whole practice is a relic of those days — of the days of Paul Hoste, Benbow, Van Tromp. Indeed, the inheritance is Noachian, and it seems to be an effort of such heredity in this direction, amidst others, to reproduce the exact conditions of that memorable cruise on shipboard to-day. Otherwise it is difficult at the present time, considering the progressive development of the Navy, to understand why this abomination is so strenuously upheld. It would soon cease, —

> "Had not damned custom brazed it so
> That it be proof and bulwark against sense."

For those who may desire some few data for guidance in these matters, it may be stated that a relative humidity should not vary much from 70 to 75. The average relative humidity of the air over the world, according to Lévy, being 72, may be assumed as the normal. The difference between the dry and wet bulb thermometers should not be less than 3° or 4° F. Briggs, the best authority upon atmospheric moisture, assigns 70 as the relative humidity in our country as best consistent with health. The air over the ocean has always a greater degree of relative humidity than over the land, and varies slightly in summer and winter. The range has been determined as from 70 to 75, saturation = 100.

The less, also, the cubic air-space per man, the greater becomes the relative humidity of the air.

The diurnal and seasonable variation and range of relative humidity seems positive from the observations before alluded to, but whether it follows the cyclical oscillations of the barometer and thermometer, as might be supposed, has not yet been determined. Future registrations may develop the law governing its periodicity.

It may be well here to allude to the point of comfort of the external temperature. This varies, but the range assigned by numerous observers is from 58° to 68° F.

All writers on etiology are agreed upon the disease-engendering effects of humidity of the air.

In 1792, Clark, in writing upon the diseases of long voyages, remarks: "The diseases occasioned at sea by heat united with moisture are fevers and fluxes;" and when treating of the means of obviating the ill effects of heat, coldness, and moisture, he says, in the conclusion of his article, "to dry up all moisture by placing stoves in various parts between decks."

Welch, assistant professor of pathology at Netley, in the Alexander prize essay says: "The main deleterious property of the general atmosphere is moisture." Again, speaking of the excess of watery vapor in the air:

"According as it approaches saturation, it [that is, the air] tends to impede the exhalation from the lungs and forms congestion. Beyond this, also, the intimate connection between organic matter and hygrometric bodies must not be forgotten."

Simon, speaking of filth ferments, states that "they show no power of diffusion in dry air, but as moisture is their normal medium, currents of humid air can doubtless lift them in their full effectiveness."

C. B. Fox remarks in his late book (1878) as follows: "Aqueous vapor possesses a powerful affinity for organic matter, and serves both to preserve and diffuse it." Again: "An excess of aqueous vapor has not only a depressing effect upon the nervous system, but it interferes with the pulmonary and cutaneous exhalations."

"Humidity," says Pringle, "is one of the most frequent causes of the derangement of health."

Fonssagrives, the authority on naval hygiene, asserts that "a damp ship is an unhealthy ship." The researches of Rouppe, Kerauden, Raoul, Bornel-Ronciere, and others all tend to exhibit the disease-producing influence of this aerial condition.

Wagner, in his "Manual of General Pathology," thus alludes to the moisture of the air: "Warm and damp air most impedes the radiation of heat from the body through the skin and lungs, causes exhaustion of the muscular and nervous systems, restrains respiration, diminishes the appetite, impairs the digestion, and increases the perspiration."

Sir Alexander Armstrong, the present head of the medical department of the English navy, says: "There can be no more fertile source of disease among seamen, or indeed other persons, than the constant inhalation of a moist atmosphere, whether sleeping or waking; but particularly is this influence injurious when the moisture exists between a ship's decks, where it may be at the same time more or less impure, and hot or cold according to circumstance."

It is hardly deemed necessary here to exhibit the influence of humidity in the production of the miasmata.

As to its bearing the relation of causation to wasting lung diseases or phthisis and scrofula, Alison, Baudelocque, Ransome, MacCormac, Carmichael, Bowditch, Buchanan, and others all bear testimony to vitiated and moist air as being the most important factor in their production.

It may be well to observe here that most of the cases of phthisis in our service, whose hospital tickets are so frequently indorsed as not originating in the line of duty, have, considering the care taken in recruiting, their origin directly in the line of duty, from breathing impure, damp air. Trotter remarks in his "Medicina Nautica:" "The nature of cleanliness is often misunderstood, and I know of nothing of that kind which is so much mistaken as the too frequent and indiscreet drenching the decks, and more especially those where people sleep, with water. By this means I have known dreadful sickness *introduced*, and I have known it removed by a contrary practice. It would be deemed extravagant to advance an opinion that the decks should *never* be washed, but I feel no reluctance in making a direct assertion that it were far better that they should not be *washed at all* than with that want of discretion and precaution which so generally prevails. It has caused the death of thousands."

Guy, W. A., speaking of vessels like the *Centurion* and others of that date, describes them as "damp, filthy, and ill ventilated," and the history of the cruise of the *Centurion* reads to-day like a romance. "In nine months her crew of 506 was reduced to 214," etc., from cold, damp, and scurvy. The health histories, however, of such vessels as the *St. Jean d'Acre*, *Neptune*, *Caledonian*, *London*, *Renown*, *Black Prince*, and others in the English navy, and of some of our own, reveal the extent of this nuisance in deteriorating the health of the crews.

Amidst the diseases induced and aggravated by excessive humidity centrally stand those of the pulmonary organs, with phthisis and other wasting diseases of these tissues, and around them scurvy, rheumatism and its associated cardiac trouble, abscesses, boils, and diseases of the subcutaneous cellular system, are grouped.

Statistics confirm these statements. Thus, on the home and foreign stations for the year: —

1872. — Total number of men, 11,570; total cases treated, 9,207; deaths, 61.

	Cases treated.	Deaths.
Respiratory system	1,020	18
Integumentary system	1,092	1

1873. — Total number of men, 12,723; total cases treated, 8,837; deaths, 55.

	Cases treated.	Deaths.
Respiratory system	896	10
Integumentary system	1,023	0

1874. — Total number of men, 13,870; total cases treated, 9,995; deaths, 64.

	Cases treated.	Deaths.
Respiratory system	1,089	12
Integumentary system	1,068	0

1875. — Total number of men, 10,141; total cases treated, 7,832; deaths, 49.

	Cases treated.	Deaths.
Respiratory system	718	11
Integumentary system	828	0

1876. — Total number of men, 11,138; total cases treated, 7,797; deaths, 41.

	Cases treated.	Deaths.
Respiratory system	558	9
Integumentary system	914	2

It is of importance to remember that the crews of vessels of war are examined as to their physical qualifications, and that these sick and death rates represent such rates of chosen and picked lives.

Contrast on the other hand the records of dry ships, few in number, for this evil of dampness is widespread in all navies, and mark the evident result of the inspection.

Collingwood's flag-ship, with a crew of 800 men, kept the seas for more than a year and a half with never more than six on her sick-list. This low rate was secured by attention to dryness, ventilation, and a general care of the crew.

Admiral Foote diminished the large sick-lists of the *Varuna*, caused by excessive wetting of the decks, by abating the nuisance.

Medical Director Maxwell's suggestions being carried out saved the crew of the *Powhatan*, in China, under like circumstances.

Admiral Boggs, when commanding the mail-steamer running from New York to Aspinwall, escaped malarial poisoning by keeping his cabin dry.

Sir Gilbert Blane very early suggested that cleanliness and dryness were of importance in preserving the health of seamen.

Trotter, when physician to the fleet of Lord Howe, rendered that fleet effective by his attention to dryness of the vessels, midst other sanitary measures. To use the words of Guy, "he helped to organize victory" by placing in the hands of his gallant chief the living material of the fleet in a state of first-rate efficiency.

The record of Captain Murray, R. N., of H. B. M.'s *Valorous*, exhibits the value of dryness on board ships beyond cavil or doubt: "That when, on his arrival in England, in 1823, after two years' service amid the icebergs of Labrador, the ship was ordered to sail immediately for the West Indies, ... he proceeded to his station with a crew of 150 men; visited almost every island in the West Indies and many of the ports in the Gulf of Mexico; and, notwithstanding the sudden transition from extreme cllmates, returned to England without the loss of a single man." He also adds "that every precaution was used, by lighting stoves between decks and scrubbing with hot sand, to insure the most thorough dryness. When in command of the *Recruit* gun-brig, which lay about nine miles from Vera Cruz, the same means preserved the health of the crew when other ships of war anchored around him lost from twenty to fifty men each; and although constant communication was maintained between the *Recruit* and the other vessels, and all were exposed to the same external causes of disease, no case of sickness occurred on board the *Recruit*."

There is but one remedy for this excessive humidity of the air on the decks — dryness. As the humidity has its causation in the constant wetting arrest the cause. Lacquer all decks below the spar-deck; keep clean; keep dry; dry everywhere below decks, from the bilges and limbers upward. Once a month would be sufficient for all such cleaning purposes as are now suggested to keep alive this abomination. To admit that there are no other means but this daily washing, scrubbing, etc., of securing cleanliness is an exhibition of ignorance and the worship of dirt.

I am well aware that an order directing such a degree of dryness and cleanliness which might be secured by lacquering the decks and other means, with the abandonment of this vestige of the deluge, would be met with evasion and subterfuge, and that no effort would be spared to render it nugatory and valueless. The writer speaks with a quarter of a century's experience and recorded observation of the failure of various reforms devised for the better sanitary condition of ships.

It has been sought, in this fragment, to present a few from the many recognized facts entering into the composition of healthy homes on shore to the production of healthy homes afloat. The broad principles of sanitary science apply alike at sea and on shore — masses in limited space, impure air, humidity, etc., agents destructive to health — to reduce to their lowest possible values all the factors that produce this insanitary environment. This is the present paramount duty of every naval medical officer, who should remember, with Richardson, that "pure air, freedom from dampness, pure water, sunlight, and an equable temperature, are the five fingers on the right hand of Health."

Two of the most potent of disease-producing agencies have been demonstrated and the means of relief suggested. In one instance such relief is an accomplished fact, and for the future a better ventilation is assured. Dryness must follow. The one means of relief is a solved mechanical problem; the relief of the other is within the province of regulation. It is within bounds to state that the present sick-rates of the service can, by attention to sanitary measures, be reduced one third, or perhaps one fourth. By law the commanding officer is ostensibly held responsible, amidst other things too numerous to mention, for the health of the crew intrusted to his command. To hold him to such responsibility, however, presupposes a knowledge on his part of all that relates to the etiology of disease — a degree of omniscience that is paralyzing. Such supposition is a self-evident fallacy.

Naval sanitation should be a matter of regulation. A subject so materially affecting the health of the service rests upon officers of all grades and corps, but more particularly does it belong to the daily scrutiny and vigilance of the medical officer as part of the duty he owes the State, and it is alike the duty of the State to promote the sanitary interests, especially in her military establishments.

I trust to see the day when a holy-stone will be looked upon as a curiosity, and its temple, the sand-locker, vanished from off the face of the deep. Then with improved sanitary surroundings will come an efficiency from better health, and arising from these a discipline more consonant with enlightenment than the semi-civilized code that now obtains.

No one is better aware than the writer how imperfect this sketch has been drawn. He has no opinion upon these matters other than those founded upon fact. He is also well aware how difficult it is to discuss separately all the meteoric phenomena of the air on account of their intimate correlation; the mere variation of a degree in the temperature, for instance, at once introducing new relations between man and the great aerial ocean in which he "lives and moves and has his being," but he nevertheless believes that the study of such relations is useful to mankind as tending to wrest from Nature the secrets she still holds of the telluric origin of those perversions of the economy which we call disease. At the invocation of her worshipers, slowly but surely, does the Goddess of Health, the daughter of Æsculapius, stretch forth her beneficent hands alike to welcome and protect her wandering children —

Omnibus ab oris maribusque.

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XIV.

PUBLIC HOLIDAYS AND PUBLIC HEALTH.

By Rev. Dr. HEREFORD.

Among the questions which touch indirectly the great subject of public health, which has drawn this conference together, there is hardly one more important than that of the excessive strain and overwork of modern life, and of what can be done to mitigate the mischievous results of this. Some of you may have seen that able essay by William Rathbone Greg, in which he depicts the drive and pressure and excitement of business life in England. He calls it "Life at High Pressure," and he gives warning of inevitable consequences to mind and body, consequences which he says are already becoming visible in the increasing frequency of brain disease and the various other ailments which betoken undue waste of vital energy.

But if life in England may be called "life at high pressure," what must life here be called? Forgive me if, only a recent settler in this country, I seem to speak too strongly, but it is sometimes useful to know how things "strike a stranger," and it is what has struck me in this matter of excessive strain and pressure which made me glad of an opportunity of speaking out for more "public holidays," and better kept public holidays, as one of the necessities of the "public health."

I am struck with this excessive "high pressure" of life everywhere! It is so even in the country. I have my doubts whether the sweet, poetical pictures of shepherd life were ever very true to nature; whether Corydon and Phyllis ever had so much time for sitting on mossy banks singing love ditties and tying blue ribbons round the necks of their pet lambs. But certainly if they could be transported in the spirit to the sheep ranches of Colorado or New Mexico, and have a few weeks' experience in herding a bunch of "unimproved Mexicans," I am much mistaken if they would not pipe to quite a different tune, or, more probably still, would find they had no time for piping at all.

And so it is throughout your rural population! That immense temptation of cheap land keeps drawing in, year after year, thousands who have little experience and little capital and who find that only by the most grinding and unceasing toil can they make a living in face of the ever-extending competition. English laborers coming over here have to work harder than ever they did in their lives! I have been taken to task for saying this. But what do your own people say, who know what rural life is in the two countries? Only a little while ago I met with a report of a lecture on England given in Boston by J. M. Bailey, better known as "The Danbury News Man," and he says: "In England the farm laborer works from six A. M. to six P. M." [with an hour and a half off for meals], "and generally takes his own time at working; often he is not called upon to work even these hours, and frequently he has an allotment of land for his own use and profit," to cultivate in his leisure. But "here the farmer routs out his man as soon as he can see to put his clothes on in the morning, and works him till eight or nine at night, under the spur of an Egyptian taskmaster, who works like a lunatic and does not understand why every one else should n't work like a lunatic, too." I visited a few weeks ago the great lumber district at Muskegon. I found that till the recent labor-strikes they worked eleven and one half hours a day, Saturdays included; and their hours are still eleven hours a day, with only one half hour intermission for dinner, — and such work for constant strain of nerve and muscle, to keep pace with the machinery, I think I have seldom seen in my life.

But it is in the city life that I am most struck with this element of strain and overwork, and cannot resist the impression that it is seriously complicating the problem of public health, which is, under the best circumstances, always serious enough in the crowding together of large populations. Let me say distinctly that all my admiration goes with city life. I have no sympathy with that worn-out piece of sentimentality that "God made the country and man made the town." I think it is in city life that man comes to his finest point, not only of mental, but of moral, energy. This material struggle which gives the key-note of city enterprise may not be the highest form of human activity, but it is in this material struggle that all higher forms of activity have their root. For making *men*, better a busy city than a lotus-eating paradise! This wonderful interlacing business and industry, putting man to his uttermost, is grand training. If Eve had had a laundry, and Adam had had to "run a store," the old serpent would not have had half as good a chance with them!

And still when all this is said, I think there can be no doubt that the business life of our cities — especially here in the West — is keen and eager and driving, entirely beyond what is healthy either to mind or body! The whole pace of business life is so quick as to task hand and brain tremendously. It is not mere "going ahead," but *racing*. A man, here, who only succeeds in working out a moderate living on the level at which he started, feels as if he had made a failure of it! It used to be said that every French soldier carried a field-marshal's baton in his knapsack; so every office-boy or clerk here dreams of being a Tweed or a Stewart! A large proportion are not only trading, but speculating; and a great deal of the speculation is simply *gambling*, involving that terrible nervous strain which is one of the gambler's hells. Even the steadiest trades are carried on in the speculative spirit. If there is business enough in any branch to keep twenty firms fairly prosperous, every one of the twenty is trying to get the whole of it that he may be not merely prosperous, but a millionaire. And so the general character of city life, certainly as I see it about me in Chicago, is engrossed, eager, piling more and more risks upon mere chances of success and incurring more and more anxieties, until it is hardly possible to think of anything else, day or night, week-days or Sundays.

And, with this, — perhaps largely a consequence of it, — the business hours are so long and the very leisure so hurried! In New York and Boston, indeed, I hear of doings more like those of English business, — men going down to office or warehouse at nine, or half-past nine. But here the hours for clerks seem to be from seven to half-past seven, and even the principals are mostly there by a little after eight. And while there, they have generally every pound of steam on. Quick work, — a short, hurried meal hour, — and I hear that many of the great business houses of this city, now that there is a little spurt of reviving trade, are keeping hard at it till nine and ten, and even eleven o'clock at night!

Well, what sort of a life is that to live? How is it for health of body? how is it for opportunities of any mental culture? How is it for the welfare of the community as a whole? I believe that society is suffering, all through, in every most vital interest, for lack of more rest, more holidays.

If this were a fitting occasion I could show you how this people is suffering from the almost total absence of any leisurely class. There is hardly any such leisurely class, and the tendency is all against its being formed. Hence, infinite mischief to both nation and city. For all matters touching the public welfare, and for which men of leisure are wanted, you are undermanned! You have the largest country in the world, with about enough men-of-leisure to man one of the old Italian city-republics! Here, in Chicago, we have a great city of nigh half-a-million people with a leisurely class about enough to run a moderate-sized village! Men have hardly leisure to vote, still less to serve on committees or do the work of citizenship. Society has to fall back everywhere on paid service, and service usually paid so poorly that, of those who enter on it, many notoriously do so as a branch of speculation — sometimes of what only differs from speculation *by a single letter*.

And just think, too, in passing, of the effect upon the general culture of life. How is any culture possible? It is possible for the women of our cities — and what carrying on of education there is, after leaving school, is mostly among them. But what can the man do? At the store, in the office from morning till night, and on the stretch the whole time? Hence you find so large a proportion of men who never read anything but the newspaper. Nay, they get out of the taste for anything else. The manager of a large circulating library told me, awhile ago, that almost all his best books are taken out by the women, and, he added, that if a gentleman came for such a work he generally seemed to feel some explanation necessary, and would say, "I want it for my wife." But how about health? My medical friends are better able to discuss this than I am, but as it was one of them who especially asked me to speak on this subject, I know well what their main verdict will be. This is *not* a healthy life. It may not result in great, striking epidemics like those which are usually treated as furnishing the most urgent sanitary problems in our cities, but every medical man can bear witness how large a proportion of the ailments among men are simply the consequence of overwork and overstrain. The strain or shock takes so many different forms that men can hardly bring themselves to realize that this the true cause. They realize it when it attacks the brain directly, and lays them down in prostrated energy or sudden paralysis; but many a man has only a chronic indigestion, and another is troubled with neuralgia, and others with lumbago, and nine times out of ten it is the same thing at the root of it! I cannot give you comparative statistics, — and I shall be thankful to be corrected if I am wrong, — but it seems to me that every day I am hearing of fresh cases of men who seemed but yesterday to have the energy of giants, struck down in feebleness and exhaustion, and ordered right away for months as the only chance of life. Yesterday, a man had business enough for half a dozen men upon him; in one pair of hands he held the lines of widely branching affairs; with one brain he watched a score of different markets, directed a hundred or a thousand men; was bearing, day by day, the year through, such strain as the general of an army has while a mighty battle is trembling in the balance. To-morrow he is sent off by slow stages to Europe or the South; a noise makes him tremble; a kind word breaks him down. Only two days before, probably, he had been saying that his business could n't spare him!

If this is a true picture I have drawn, and a picture which is becoming more common every day, — as I believe it is, — and if this, and scores and scores of less marked and yet still unmistakable cases of kindred nature are the fruits of this "life at high pressure," I think I have made out a case which demands the attention of all thoughtful people.

Of course it is more easy to point out an evil than to suggest a practicable remedy. Mere declamation against absorption in business is very cheap. The habits of a people are only very slowly changed. Business men tell me, and I know it is largely true, that they *have* to be absorbed in business; that if they were to slacken they might go to the wall.

True, and yet no one can live in a business community, and not see that the very fact of men generally having got so desperately engrossed in business leads to that business being spread over a great deal more time than is really necessary. It sometimes happens that men go so long without food that they "get past their appetite," as it is called, feel as if they did not want to eat, cannot eat. Yet it really is only a sign how desperate is the need. Thus, too, men may get so accustomed to doing without leisure that they lose the very wish for it, are content to spend every waking hour in transacting business or thinking about it. But it is not a sign that they do not need rest and leisure; the very opposite. And the mischief affects more than themselves. How often have I seen a whole establishment, made up of scores of men and youths, who craved more leisure, kept going as if by a slave driver because the head of it had got past *his* appetite for such waste of good business time.

But there is something more to the purpose than this. After all, I do not think it is any slackening of energy that is needed, so much as *more* public holidays and *better kept* public holidays!

I do not think Americans are at all aware, till they go abroad, how *very* poorly off life in this country is in the matter of holidays. In England people seize every excuse for a holiday. In the north of England, Good Friday is kept as universally as Sunday; Easter Monday and Tuesday most workplaces are closed all, or half, the day; many factories and large stores never open from Good Friday till the following Tuesday or Wednesday. Then Whitsuntide is a slack time; all business houses close for several half days, and the employees can generally get off in relays for the whole day. Then there are four "Bank holidays," lately instituted by an act of Parliament, which (in addition to Easter Monday and Whitmonday, which were usual holidays before) had made the first Monday in August and the 26th of December absolute holidays in banks and public offices, and the rest of the community is following suit. All through the country every town or village has traditional holidays, often dating back to the times of the Druids. At Christmas there is a whole space of ten days, from Christmas Eve to the day after New Year's Day, during which little business is done, and the whole staff of the firm, even when open, is represented by a mere "corporal's guard."

But more important in the old country than any of these, as a constant leavening of the busy life of commerce with leisure and rest, is the *Saturday half holiday*, which has now become almost universal in the large centres of business.

Compare with this showing the holidays in one of our cities here. It seems to me we have very few holidays. Christmas Day is nothing like the day it is in the old country. Good Friday, business goes on just as usual; as for Whitsuntide nobody seems to know anything about it. The Fourth of July, Thanksgiving Day, and New Year's Day seem to be the only days on which there is a general cessation from business; and on Saturdays, though a few of the larger firms have begun a sort of rudimentary half holiday, closing at three o'clock, yet the general working and business of the city, alike for merchants, clerks, artisans, and laborers, seems to go on to the usual hour, the same as the other days of the week. Indeed, so few are the holidays here that they are hardly enough to keep alive a wholesome sense of the value of such breaks in the continuous strain of life. People don't seem half to care for those they have; don't seem glad to avail themselves of opportunities for others. I remember one of my friends here saying to me awhile ago: "An American with a holiday is the most miserable man alive. He does n't seem to know what in the world to do with it." Of course that is a little exaggerated, and yet there is a great deal of truth in it. Last Fourth of July it seemed to me that a very large proportion of the older people were just hanging about, feeling rather at a loss for something to do, with the wise exceptions of those who accepted the situation, threw themselves into the spirit of young America, and nourished their patriotism on crackers! I have been very much struck, too, with the very small proportion of people who have any holiday occupation — those "hobbies" of various sorts which are one of the most essential refuges from onesidedness and care. So, men having nothing that they much care to spend their holidays upon, those which they have are poorly kept, and they grow careless about having more. But I am persuaded that in this holiday direction lies the true solution of this great problem of busy, strained, overwrought life.

I might go on to speak of the one great weekly holiday, which religion *won* from the toil of the ancient world, — and which I believe that only religion will effectively *maintain*. For I think there is much to be done, in the way of clearing away Puritanical restrictions, before our Sunday is that day of full, happy refreshment that it might be. But I prefer to spend the rest of my half hour in speaking of another institution of leisure, of which I have seen the beginning, the success, and the immense benefit in England, and which I should like to do my little part towards introducing or extending here. I refer to the plan of a Saturday half holiday. I am just old enough to remember the starting of this in England. It is worth remembering that it began in Manchester, — about the hardest-working, most driving business city in England. I was put to business thirty-two years ago, when the old business régime still prevailed. Working-men, such as carpenters and masons and painters, had for long been accustomed to cease work at four on Saturdays; but the offices, and the great warehouses, all kept open till six, or half past six, or seven, and the shops or stores till later still. And there was this difficulty in making any change in Manchester, that Saturday was "Market-day," the day when all country produce was brought into the town, and the country people came in in shoals to buy their goods and transact the business of the week.

But the movement was begun, not from any public conviction of its desirableness, but from the conviction of a few leading citizens. It began, I think, with the lawyers and the architects. They were not dependent upon the calls of chance customers, and so could act immediately in the matter, without any loss. I am not sure whether the bankers preceded them or came next. All these began at once to close at one o'clock. Then a few of the large wholesale stores, which were prosperous enough to be able to take their own stand, followed suit. Once the example set, more and more kept taking it up. Within a few years all places of business except the retail stores and markets closed uniformly at one o'clock. Then the retail stores, frequented by the well-to-do classes, finding that their customers were all away home by one o'clock, so that they had no trade worth keeping open for, began to close also. Meanwhile the "Ten Hours' Bill" for factories had been passed, and the way in which this was permanently settled was that the work should go on ten and one half hours for five days of the week, and on Saturday close at one o'clock. And this has been followed by the other artisan trades. So that gradually all labor, except in retail stores in the suburbs, or on some of the busiest traffic-streets, came to cease at one or two o'clock on Saturdays. And now if you should go into Manchester you would find it, in all its business quarters, by two o'clock on Saturday afternoon, as silent and deserted as a grave.

The benefits of this to the community have been such as it would be difficult to exaggerate. There has not been less business done, only it has been rather more concentrated. But to domestic happiness, and social life, and intellectual culture and general health, the gain has been immense. Of course there are plenty of people who misspend the afternoon, as there were before plenty who misspent their evenings and their Sundays; but, on the whole, the community has been improved and elevated all through. Crowded excursion trains take thousands into the country. Tens of thousands of young men are busy cricketing. The Rifle volunteers — of whom Manchester numbers six or seven thousand — assemble for drill and practice, have a good march out into the country, and learn to use their legs, if not their arms! And there are various field naturalist societies, the members of which go off into the country in groups, studying botany or geology, or looking for those curiosities of butterfly and beetle which the youth of America comprehends under the one generic term of "bugs."

Now, I would ask why should not the same thing be possible *here?* In England, it has spread — so far as all factory and workshop labor are concerned and all handicrafts — through the whole country. There is hardly a large town or city which does not keep the Saturday half-holiday in all its business branches. I believe that it would be just as beneficial and that it is just as practicable in America. It needs a few public-spirited men in each community to start it — and, once thoroughly started, I believe that it would spread. I would, too, that the workingmen would take it up, — from what I have seen of the good that it has been to them in England, I am sure it would be worth more than any temporary increase of wages. Of course there would be some who would misuse it; but as John Bright said of the franchise, so we may say of all wholesome opportunity of leisure, "The best way to educate men to use it is — to give it to them!"

XV.

SANITARY SAFETY IN RAILWAY TRAVELING. — SUGGESTIONS IN THE INTEREST OF TRAVELERS AND CARRIERS.

A REPORT SUBMITTED AT THE CHICAGO MEETING.

By THOMAS J. DUNOTT, M. D.,
Of Harrisburg, Pa.

THE question of how best to promote the sanitary safety of the traveling public is one worthy of close investigation. So far as my information enables me to form an opinion, this subject has not as yet awakened the interest of "sanitarians" to the same degree that the contingency of accidents, how to prevent them, and to deal with their results, has that of the surgeon, and the builder of railroad coaches. Neither does the fear of infection from contagious disease make the same impression upon the mind of the traveler, as the fear of a collision, or derailment of trains. Few undertake a distant journey without some lurking idea that possibly they may never reach their destination, because of an insecure bridge, a loose rail, or some other unknown weak spot, in the train or on the track, which, in a moment, may be the occasion of fatal disaster. But the possibility of contracting small-pox, or some form of malignant fever, or the inception of syphilis from the drinking vessel (conveniently accessible under the spigot of the water cooler) rarely disturbs the imagination, or awakens a passing fear. Nevertheless one risk is greater than the other, and if it be true, that the average distance which each passenger travels before he owes his life, or a limb, as toll levied upon the journey, is nearly 4,000,000 miles (as stated by Charles F. Adams), the matter of sanitary safety is the more important inquiry of the two.

The ingenuity of skilled constructors has been taxed to the utmost to provide for the greatest physical safety, personal comfort, and even luxury of the passengers; but it is not by any means certain that the effort to exclude dust, noise, moisture, and cold, has not, in its accomplishment, interfered most seriously with his sanitary safety. Whilst the public demand has secured the most luxurious accommodation, it will be equally efficacious in obtaining the most complete protection to health, when it is proven that the luxurious surroundings are aids to, and concealments of, the insidious approaches of disease, and that damask and gold hangings, plaited and folded in the highest style of the upholsterer's art, offer secure hiding-places for the germs of scarlatina and small-pox, and other diseases. Sanitary work is required to instruct the public mind to accomplish this needed reform, for the sad history of Shreveport or Memphis may be repeated in the near future, and reasons for increasing sanitary vigilance in every direction multiply with each fleeting year. The history of every great pestilence has been shown to be the history of defective sanitation or else its positive neglect. Most important to the argument, so far as the work is concerned, is the noted fact that every fresh centre of contagion is found to be located on some great route of public travel. In by-gone times the cholera visitation required many years to seriously compromise the welfare of the western hemisphere. When it began its journey, it dragged its slow length along with the weary pilgrim journeying from the sacred Ganges back to his home — now, in consequence of the extension of railroad traffic, it may start from sea-port cities and within forty-eight hours be scattered over half a continent. The topic under discussion, then, is not limited to inquiries respecting the safety of persons in transportation, but applies equally to those which affect the welfare of territories and countries which might never suffer from the ravages of certain forms of pestilence, were not the seeds of the disease liable to be spread "on the wings of the morning." Of what value, then, so far as the safety of the traveling public and of distant localities is concerned, is the quarantine inspection at ports of entry, if a similar rule is not exercised over all outgoing trains? Well do I remember the language of a paper read at the Baltimore meeting of this Association in 1874, wherein it was stated that during the epidemic of small-pox in Philadelphia, in 1872. clerks and other employees of the business firms were engaged in selling to the inland trade while the traces of recent small-pox were still visible upon their countenances, and were also seen to be engaged in packing goods which were subsequently sent all over the country, thus spreading in numberless places an infectious disorder which the science of the age was competent to have strangled in its birthplace. Those affected with the disease were also to be seen riding to and fro, upon the street cars and trains, from their homes to their places of business. So familiar, indeed, were such instances that it seemed as if all dread of the disorder had vanished. A still more striking illustration of the manner in which travelers and distant communities may be infected is taken from the Government Report on Cholera Epidemic in United States in 1873. On page 10 of this report it is stated that three distinct outbreaks of cholera occurred at widely remote points in the United States from poison packed and transported in the luggage of immigrants from Holland, Sweden, and Russia. "The people and the vessels in which they were carried had been perfectly healthy, and the people remained so until their goods were unpacked at Carthage, Ohio, Crow River, Minnesota, and Yankton, Dak., respectively. Within twenty-four hours after the poison particles were liberated the first cases of the disease appeared, and the unfortunates were almost literally swept from the face of the earth." Such evidence is convincing proof that none but the most rigorous sanitary measures will prevent immigrants coming from an infected country, being carriers of infectious diseases, not only to their distant homes, but also into the trains which transport them, provided they are, on landing, permitted access to their luggage, which at sea is in the hold of the ship and, therefore, out of reach. The epidemic from which the above mentioned cases derived their infection was traced by following the great routes of travel into Asia to the foot of the Himalaya Mountains, where it originated in 1867, to where it died out in the Mississippi Valley, in 1873.

"Since the main source of contagion is the disease germ, which is given off in some instances during the early stages of disease before the patient is aware of the nature of the illness, it follows that passenger trains are especially liable to become active agents in the causation of disease. How to limit and prevent this liability are questions to be answered by the sanitarian. The more thorough the knowledge of the etiology of contagious disorder, the nearer will we be to a solution of the many difficult problems presented. As a general principle it may be stated: first, that the specific disease-germ and its concentration are, in all instances, sufficient factors to originate; and, second, that a predisposition to infection may easily be generated in the healthy by anti-hygienic surroundings. The atmosphere of a crowded passenger-car, and, particularly, of the sleeping-car, is, under certain circumstances, loaded with foul exhalations from the breath and persons of those who occupy it, the free circulation of pure air is impeded by the hangings and screens which surround each bed, and should the temperature be low the admission of outside air curtailed, because of the difficulty of warming it. The danger here is manifest, and, without doubt, many persons suffer seriously in their vital forces from protracted exposure to such polluted atmosphere. Sometimes the poison of scarlatina, diphtheria, small-pox, or yellow fever lurks in ambush in the bedding or drapery, ready to attack those who are thus rendered defenseless in resisting power. In an article published [1] in the "Sanitarian," entitled the "Public Sanitary Control of Diphtheria," the statement is made that the first fatal case registered by this name in the city of New York occurred on the 20th of February, 1850. While it is fully admitted that the new name is not descriptive of a new disease, it does not appear that during the previous century any medical or sanitary authority has branded it with being a prominent factor in swelling the mortality percentage in the largest city of the continent, but within the following seventeen years this scourge has become domiciled not only in New York, but in almost every populous town from "Maine to Nebraska." It would be useful to know how much agency in planting the seeds of this infectious disorder can be traced to the increment of railroad traffic within these years.

In this connection I may be permitted to mention that in the year 1874 I attended, in an interior town of Pennsylvania, a patient with relapsing fever, all the symptoms and peculiarities of the onset and progress, as well as some of the sequelæ, of this most peculiar fever being well marked. How the patient contracted the disorder we could not imagine until, accidentally, we learned that, as a matter of convenience, she traveled to a neighboring city in the "emigrant train," and thus was the solution given.

Another danger to which travelers are exposed has not, so far as my

[1] February, 1874, by Dr. E. Harris.

knowledge enables me to speak, been much referred to by "sanitarians" at heart in this connection. It is one of so much importance that no apology seems to be necessary for its introduction. I refer to the danger of syphilitic infection from using the drinking vessel always to be found under the spigot of the water-cooler. Very fastidious persons go provided with a cup, or else remain thirsty to the end of their journey, but as a rule the traveling public takes no precaution. Children and ladies are most liable to infection from the fact that so frequently they have cracks and fissures about the lips and angles of the mouth, the denuded surfaces of which can readily become the avenues of systemic infection. A drinking vessel used in common may be contaminated by persons affected smearing its rim with the foul secretions from the mouth which exist during the secondary stages of the disease. Within a few years I have recollection of three cases occurring in consequence of some such unrecognized contact; all were followed by constitutional symptoms, and the nature of the loathsome affection entirely unsuspected to the patient until made manifest by their occurrence.

Were it possible to register and tabulate every case of contagious or typhoid disease contracted by individuals while journeying, or to enumerate the various epidemics which within the last quarter of this century have devastated localities, having been introduced by some traveler dropped by the wayside to be a reason of death to others, the public mind would be shocked at the terrible array of facts presented, would be prone to take counsel of its fears, and insist upon the exercise of every known precaution against the possibility of such accidents occurring in the future. The restrictions to travel imposed by a thoroughly frightened people would be so onerous as almost to destroy the business welfare of the country. Under such circumstances what a relief it would be to know that the therapeutic science of the day had discovered some specific antidote for each malignant feature which would oppose an insurmountable wall to the progress of every pestilence, and thus limit it to a narrow circle surrounding its point of origin. Eighteen hundred years of patient, untiring zeal in the endeavor to discover such specifics has demonstrated the folly of the expectation. In spite of all progress in therapeutic science, the march of cholera, small-pox, diphtheria, relapsing fever, and almost every other infectious epidemic is as irresistible as ever. The physician who limits himself to purely therapeutic measures in the management of great epidemics opposes a feather to the club of Hercules. What has been denied to therapeutic has partially been revealed to sanitary science, and in vaccination, ventilation, the appropriate use of disinfectants, boiling water, and fire are found weapons adequate to the occasion.

The well-defined value of hygiene in its application to the prevention of disease in dwelling-houses, school-rooms, churches, and the tenements of the poor, is admitted by nearly all intelligent people, but the *observance* of the necessary regulations is neglected by a majority. At times, therefore, the compulsory use of hygienic measures becomes as much the duty of the State as the establishing of quarantine at ports of entry. Municipal and State authorities have almost entirely ignored the dangers incidental to railroad transportation of passengers and freight, and of course the proper means of averting them is now entirely in the hands of the railroad officials. I think most of them are wide awake in the matter, and have distributed printed and written circulars, instructing in the most complete manner possible how employees shall look after the sanitary condition of their rolling stock and passenger cars. At every passenger depot where inquiry has been made by me I have found that the most scrupulous care in cleaning and ventilating the cars before they are again used is inculcated, and that it is the duty of the proper official to inspect them after the cleansing process has been finished — every necessary facility is furnished those engaged in the business of cleaning in the shape of hot and cold water, and disinfectants, etc., are always on hand.[1] So

[1] The following direction, to employees issued by the Pullman Palace Car Company during the prevalence of cholera are of interest in this connection : —

1. Passengers already attacked will not be admitted to the cars of this company, and if any are attacked while on the cars, the train conductor should be asked to leave them at the first suitable station.

2. Assistant superintendents will keep ready for use, in barrels conveniently placed, a disinfectant made of material mixed in the following proportions: 10 pounds of copperas, 1 pint of carbolic acid, five gallons of water; and will see that bottles of it are carried on all cars in service.

3. Conductors or porters in charge of cars, will sprinkle the urinals, hoppers, and floors of water-closets three times a day with the disinfectant named above, and oftener, if thought necessary.

4. Should any one be attacked with cholera on a car, every possible care will be taken to prevent any matter vomited or excreted from touching the bedding, seats, or carpets, using sheets freely to do so. Should the bedding or upholstery be soiled, notwithstanding the precautions referred to, the place must be thoroughly cleaned at once, and then well wet with the disinfectant. Linen soiled by the vomitings or excreta of cholera passengers will be put in the stoves and burnt.

5. Assistant superintendents will take from cars immediately on arrival all articles soiled by cholera passengers, and have them cleaned and disinfected the second time before returning them to the cars. They will, also, when a case of cholera has occurred in a car, have the car disinfected before sending it out.

6. A pint of the disinfectant will be poured into every water-closet at offices of the company twice every day.

[This section contains full descriptions of the character of the disease, the common method of avoiding its spread, etc.]

Among less important directions are the following : —

Cleaning of Cars. — Assistant superintendents will cause the cars to be regularly and thoroughly cleaned and ventilated. The vestibule carpets will be taken up when cleaning the car, and the aisle and floor carpets whenever any dirty work is to be done in the body of the car. The bedding will be opened and aired at the end of each trip, and conductors and porters required to exercise proper care and diligence in cleaning and dusting their cars while on the road. A place will be designated in each car where boots should be blacked.

Infected Cars will be withheld from service under any circumstances until purified by the most thorough disinfection.

(·z) Assistant superintendents will keep ready for use a disinfectant made of material mixed in the following proportions: 10 pounds of copperas, 1 pint carbolic acid, 30 gallons of water; and will see that bottles of it are carried on all cars in service.

Ventilation. — Care must be exercised in the ventilation of cars while on the road. In warm weather all the ventilators must be kept open, and the sash in each door may be lowered. The "Carroll," or other iron ventilator, should always be opened in preference that the foul atmosphere and offensive water-closets, often noticed in the car, must be due either to neglect or faulty construction, especially of the water-closets. Many of the latter are so badly arranged that the deposit excretions fall upon the wheels, and are, in consequence, distributed while the train is in motion over the track and bottom of the flooring of the car. Surely this defect of construction ought to be remedied. Again, the placing of the tank holding water for drinking purposes immediately above the urinal is in a nasty proximity to it, apt to excite disgust, which is increased on learning that, when for certain purposes the tank is emptied, the waste pipe which serves as a conduit is connected with that which carries away the urine flowing from the urinal. It would be better to remove the tank entirely and supply the wants of the passengers from a well-constructed water-cooler having a filter attached; this, without interfering with space, could be placed in a more agreeable locality.

The ventilating and heating apparatus of the best constructed coaches seems to be excellently well adapted for maintaining warmth and purity of air; but would it not be better if placed in the centre of the car, the stove securely bolted to the floor and ceiling, its flues connected with a series of pipes arranged on each side of the aisle, these covered with a platform on which could be placed the seats. The feet of the passengers could then in cold weather always be kept warm, and the horrible conflagrations which are liable in case of collision from crushing of the stove would, in many cases, be avoided. If the ventilating registers opened into a flue running like a horizontal chimney on the top of the car its entire length, the foul air, which is always the upper stratum, could be, as it were, sucked out by a draft not too intense to chill, when the fire in the stove from any cause became low.

to the deck sash. On approaching a tunnel ventilators and windows should be closed, and after its passage promptly *reopened*. Conductors must exercise judgment in the matter of ventilation, doing all in their power to cause a free circulation of air through their cars, making frequent and careful inspections, *en route*, for that purpose. In using the "Carroll" ventilator open both of them in each pair at the same time.

Heaters and Stoves. — In building a new fire in Baker Heaters, remember that the smallest fire you can keep burning is the best for starting the circulation of water in the pipes, and at other times the *condition* of the fire is more important than the *quantity*. Keep the coil free from ashes and a low fire will warm the car. The effective service of stoves require that the wire screen over the end of the stove hood on the roof of the car should be kept clean by frequent brushing with a stiff scrubbing brush or broom, so that the air can get in by the stoves freely and drive the heat back into the car.

(2.) Care is to be taken at all times to keep securely fastened the safety catches on doors and lids of stoves and heaters.

Uncovered Lamps or Candles will not be used in cars at any time.

Disinfection. — A piece of common soap will be carried in the urinal of cars, and a bottle of disinfecting liquid used in sprinkling in urinals and hoppers daily.

XV.

ABSTRACT OF A REPORT BY ASSISTANT-SURGEON CHARLES SMART, U. S. A., ON CERTAIN POINTS IN MEDICAL CLIMATOLOGY.

THE following is an abstract of a report made by Dr. Smart to the surgeon-general of the United States army, under date of June 30, 1876, which is accompanied by a lengthy series of tables of observations made by Dr. Smart at Fort Bridger, Wyoming Territory.

What is wanted for medical purposes is not a record of the dead or absolute temperature such as is given by ordinary thermometers, but a measure of the rapidity with which the animal heat is carried off. There are three principal factors which make up the sum of what we call climate in relationt o animal heat, — the absolute temperature of the air, its motion, and the moisture contained in it.

Dr. Smart attempted to determine the value of these factors by observing the rapidity of fall of the mercury in a thermometer heated to the average temperature of the human body, 98° 4′ F., under varying force of wind and degrees of moisture.

He first found by experiment that the same thermometer heated to 98° 4′ F., when exposed in the calm to the same temperature, always took the same time to cool to a given temperature, say 80°. Expressing this fall of 18° 4′ F. as unity, he found that an exposure of one minute in the calm produced a fall of a certain fractional part, say .2. Now if he exposed it to the same temperature for the same time, but when wind and moisture were acting, and found that it fell .5, it was clear that .3 of the effect of cooling was due to movement of the air and moisture. The first step was the determination in a calm day, and a close room, of the rapidity of fall of a given thermometer from 98° 4′ to various lower temperatures. Of course the rapidity of fall varied with the amount of difference in temperature, and the following results were determined: —

With one minute's exposure to a temperature of

88° 4′, making a D. of 10°, the fall was .180 of D.
78° 4′, making a D. of 20°, the fall was .200 of D.
68° 4′, making a D. of 30°, the fall was .207 of D.
58° 4′, making a D. of 40°, the fall was .215 of D.
18° 4′, making a D. of 80°, the fall was .240 of D.

By calculation and experiment he thus obtained a scale for his thermometer of the influence of temperature alone, wind and moisture excluded.

This thermometer, then, when raised to 98° 4′, and exposed to cold, wind, and moisture for one minute, would show by its fall at the end of that time the degree of calm cold which will carry off its heat with the same rapidity, and the observer could thus record the influence of all these climatic factors, expressed in terms of temperature alone. That is, instead of recording a temperature of so many degrees, a wind of so many miles per hour, and a dew point or relative humidity of so much, he can say that all these together are equal to a certain number of degrees of calm cold, and make a similar demand upon the powers of the human body.

A long series of observations were then made with the same thermometer in the open air, the velocity of the wind and the moisture of the air being at the same time recorded. The effects of wind are shown by the following table. Taking the fall in a calm at unity, or .1.

Wind, ¼ mile per hour, fall, 1.42.
Wind, ½ mile per hour, fall, 1.54.
Wind, 2 miles per hour, fall, 2.03.
Wind, 8 miles per hour, fall, 3.01.
Wind, 20 miles an hour, fall, 3.60.

Combining these observations with those of the first table, and supposing the absolute temperature to be 68° 4′, giving a D. of 30°, and the velocity of the wind 8 miles per hour, the ratio of which is 3.01, we find that the cooling effect in the body of a temperature of 68° 4′, with wind at 8 miles per hour, is equal to a temperature of 20° F. in the calm. In conclusion, he points out the importance of this kind of observation and registration, in considering the relative value of various health resorts, and expresses his intention of continuing his observations and making their results more accurate.

In conclusion I would remark that Dr. Smart undertook the investigation and made his report without being aware that work of a similar character had been done elsewhere. Those who wish to follow out the subject are advised to consult a paper by Jonathan Osborne, "On the Employment of a Heated Thermometer for the Measurement of the Cooling Power of the Air on the Human Body," published in the "Dublin Quarterly Journal of Medical Science," for May, 1862, and a paper by J. W. Osborne, "On a New Meteorological Instrument," published in the "Proceedings of the American Association for the Advancement of Science, for 1875." This instrument was exhibited to this Association at its last meeting.

XVI.

SANITARY PROBLEMS: THE PROPER AND RATIONAL METHOD IN WHICH MUNICIPAL BOARDS OF HEALTH SHOULD BE ORGANIZED.

A PAPER READ AT THE MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION, NOVEMBER 10, 1874.

BY JOHN L. LECONTE, M. D.

"Provided that our aspirations are pointed in a right direction, we must not allow them to be dampened by the consideration that they pass beyond what can now be turned to immediate profit." — JEVONS' "PRINCIPLES OF SCIENCE," 1248.

FOR the first time since the termination of my official duties in the Medical Corps of the army of the United States, I recur to the consideration of sanitary problems, such as during my period of service were constantly before my mind. It is to your courtesy that I owe the opportunity, and to you I return my grateful acknowledgments.

These subjects must, however, be approached by a civilian from a very different stand-point from that occupied by a military officer. The officer writes for the information of his superior, who stands in a position higher than himself as regards authority, and sometimes also in the scope of his knowledge, or he writes to compel the obedience of those who are subject to his command. The civilian expresses his opinion to an intelligent public, who, however well informed on other subjects, he believes to be in need of further instruction, which may enable them to accomplish better the common end in view.

It is therefore with pleasure, though also with diffidence, that I invite the public, through this Association, many of whose members have given great attention to the subject, to consider with me the proper and rational method in which municipal boards of health should be organized.

Lest I should be accused of rashly endeavoring, without warrant, to promulgate doctrines subversive of the system now adopted, and simply for the purpose of finding fault with existing authorities, I will preface my remarks with two quotations, one from the correspondence of Mr. J. W. Forney, the intelligent and public-spirited editor of "The Press," a leader in political opinion and action in this city and State; the other from a report adopted by the Citizens' Municipal Reform Association, a large and respectable body of citizens, who for some years past, with limited success, have been endeavoring to improve the administration of our municipal affairs.

Mr. Forney, in "The Press" of September 11, writes as follows: "I wish I had Mr. Stokley and Mahlon H. Dickinson here now, to walk or drive with me through these Paris streets. I am not mayor of Philadelphia, or superintendent of highways, but if I were either I should learn from these magnificent foreign cities a good deal. Where I board is in a street like Locust, between Sixth and Seventh, Philadelphia, only more shops, more travel, and therefore more excuse for dirt. I declare to you it is as clean always as the floor of a banking-house. This morning I got up early to write my letters — at seven o'clock — and I saw the cart to carry offal come on. The servants of the house were out to deposit their tributes, the fountains were running, and the Rue Caumartin was made ready for the day. Observe, Mr. Stokley and Mr. Dickinson, this is so all over Europe — in England with her queen; in France with her military president; in Germany with her emperor; and in Switzerland with her annually elected republican executive. Why? Because the law is made to be obeyed, not to be broken. Because a public trust is more sacred than, or as sacred as, a private trust. These people get crazy every decade or so, but their municipal administration is the best in the world."

The following is condensed from the report concerning the Board of Health of the Citizens' Municipal Reform Association, Philadelphia, March 16, 1874: —

"The report states that by act of Assembly, March 18, 1869, all powers relating to cleaning of streets, removal of garbage and other filth, were transferred from other authorities and placed in the Board of Health. The Board of Health, before consolidation in 1854, was composed of members elected by voters in the different wards of the city. By act of April 7, 1859, the election was abolished, and a board of nine respectable citizens and electors of said city of Philadelphia substituted. Of these respectable citizens three were to be appointed, for one, two, and three years respectively, by the judges of the District Court, three by the Court of Common Pleas, by the Supreme Court also three, and the Select and Common Councils were to elect three, and each of these bodies was in addition to select one member annually, to take the place of members whose time should expire. This made a body of twelve instead of nine, as provided by law, but, under the new Constitution, the power of appointment is taken from the Supreme Court, so that in three years the number will be reduced to the legal limit."

This excellent report concludes as follows: "By article 6, section 4, the present Constitution provides that 'appointed officers, other than judges of the Court of Record, and the Superintendent of Public Instruction, may be removed at the pleasure of the power by which they shall have been appointed.' And if, as seems apparent, the gentlemen of the Board of Health cannot perform their duties when they are furnished by the law with every possible authority requisite, and will not resign, the court whom they represent might beneficially for the public enforce this section, and supply the vacancies by those who would better regard the city's welfare."

From the brief narrative which I have given you several important deductions may be derived; but before naming them I will state what are, in my opinion, the two fundamental causes of most of the well-founded complaints about the manner in which the public interests suffer from want of attention to duty by our public servants.

First. That many offices are filled by election, which require for their proper administration knowledge or qualifications of which the voters are not competent to judge. As, for example, when, in a recent political convention in Nevada, a candidate was nominated for the position of State mineralogist.

Second. That appointments are made to offices by functionaries, who, however well qualified to occupy their own positions, are equally unable with the public to judge of the fitness of their appointees, and select them upon the recommendations of persons who are either insufficiently acquainted with the duties to be performed, or who have some corrupt purpose to be accomplished.

This much being premised, I would say: —

A. In opposition to the opinion of many eminent writers on political subjects, *it is possible*, in a community of intelligent voters, that power of election residing in the mass of electors may, without revolutionary means, be acquired by smaller bodies of citizens.

If this be conceded, it will prepare the way for causing several classes of public officers, which are now elective, to be made appointive, in a similar manner to that in which the choice of the members of the Board of Health has been taken from the body of citizens and vested in the courts and municipal bodies. I am, however, free to say, that the experiment has thus far worked without benefit to the community, in consequence of the tendency of the second error in the method of making appointments, as mentioned above. To correct this evil, it is necessary, —

B. That the officers in whom the power of appointment resides should act on the recommendation of those societies or organizations which have been formed to promote the particular branches of science or technical knowledge upon which the duties to be performed depend.

It is obvious that the proper execution of legal or political duties, which arise from purely human adjustments of interests, require a very different kind of mind, and a distinct method of education, from those which are necessary to interpret, for the benefit of the community, the laws of nature, or, as I would prefer to express myself, the laws of God, as manifested in the material universe.

Accordingly, we see that with the beneficent action of our system of general education, and the desire for personal advancement exhibited by a large number of our citizens, men may be found in small communities capable of filling the highest executive, legislative, legal, or even diplomatic positions, with credit to themselves and benefit to the public. Under the pressure of partisan spirit, men previously unknown have been elected, or chosen, to high position, filled it honorably, and retired with the esteem of the whole community.

It is by no such summary process that men of science are made. The priests of nature, who carry on unceasing war against the children of the four great Bogies, — Self-will, Ignorance, Fear, and Dirt,[1] — are not educated by the processes of the common school, nor are they elevated to

[1] Kingsley, *Water Babies*, 319.

position by the votes of their fellow-citizens; rarely, indeed, are they by the choice of the popular ruler placed in position commensurate with the usefulness they are capable of exercising. Theirs is the privilege by unselfish and unremunerative labor to add to the sum of human knowledge, and after their death to be remembered as men who have added to the glory of their country, but have not been allowed during their lives to contribute to the welfare of their local community.

It is to such men that I wish to invite your attention. They are known to their compeers here, and their labors are valued by them and measured by their colleagues elsewhere. Yours is the task to command them to be recognized and used for the public benefit.

To conclude, the functions of a municipal board of health can, in my opinion, be properly performed only by composing it of three classes of men, each member fully experienced in his own department and each in the order in which I enumerate them, not subject to control by the others: —

First. Students of sanitary science, who will in most cases be medical men, recommended by the chief medical society within the municipality; if there be none possessing sufficient responsibility or reputation, then on the recommendation of some other medical or scientific society of the State. Two or three times the number to be selected should in all cases be recommended, in order to avoid any appearance of dictation to the appointing power.

Second. Men eminent for prudence and judgment in commerce, to be recommended by the most respectable commercial organization, — Board of Trade, Chamber of Commerce, or whatever else it may be called.

Third. Members of the municipal bodies, who may be ready at all times to represent the Board of Health in the meetings of councils.

The functions of these three classes of members will be, in brief: the first, to decide and order what is necessary to be done for the protection of public health; the second, to devise and carry out the means of executing the orders with the least inconvenience and expense to the community; and the third, to procure the necessary appropriations for the purpose.

It is proper to add, though it would seem a bald truism, if it had not in this city at least passed out of mind, that the officials charged with these important duties, affecting life rather than property, should be paid for their labor. It may be incredible to those living in other cities, and certainly will be unintelligible to every foreigner of education, that while municipal officers performing only legal, or even clerical duties, of a very low order, such as might be done by persons of extremely limited acquirements, receive salaries or emoluments greater than those of the ruler of the nation, those men upon whom devolves the protection of our health and our lives against the pestilential effluvia of a dense aggregation of human beings are expected to perform their labor gratuitously. Is it a matter of surprise that the work is badly done? Or that they should fail to represent to the people the causes which interfere with a proper and honorable administration of the duties confided to them?

XVII.

REPORT ON PLANS FOR COMPLETE AND AUTHENTIC RECORDS OF DEATHS AND THE CAUSES OF DEATH IN THE UNITED STATES.

PRESENTED TO THE AMERICAN PUBLIC HEALTH ASSOCIATION AT ITS CHICAGO MEETING, SEPTEMBER 27, 1877. ACCEPTED, AND ORDERED TO BE IMMEDIATELY PRINTED.

BY E. HARRIS, M. D., *New York.*

As the art of healing depends chiefly upon the science of pathology, so the cure and prevention of diseases require a definite knowledge of causes and contributing circumstances of the inception, progress, and injurious results of the maladies by which lives are jeoparded or destroyed.

No truth in sanitary science and in public health administration is more obvious than that the *faithful inquiry into the causes of mortality in any city or community is an essential duty in the public sanitary service.* The late Prof. Edmund A. Parkes, whom we all recognize as a master in hygiene, correctly viewed this fact when he said, "It is impossible for any nation or any government to remain indifferent, when in figures that admit of no denial the national amount of health and happiness, or of disease and suffering, is determined." Untimely death, preventable disease, and all that such sickness and mortality imply of suffering, of orphanage, of want, and of blighted hope and usefulness, emphatically mark the value that should be set on health and longevity.

The science and art of healthful living being so intimately associated with faithful study and conclusions concerning causes of mortality and concerning the control and prevention of the avoidable causes which produce premature death, the argument for the accurate and complete knowledge and records of the causes and essential circumstances of mortality in a community and throughout the country may be deemed sufficiently strong to warrant States and cities in the adoption of very exacting laws and regulations for recording the causes of death, and making a faithful registration of every individual who dies. The individual records, however, become publicly valuable just in proportion to their numbers and their complete accuracy and comparability. Uniformity of methods and details in the records, and the correctness and faithful maintenance of standards of description of the causes of mortality, of course, are essential. Says Professor Beneke, as an expert referee, to whom the German commission on vital registration submitted the details of this subject for a report: "Mortality statistics are the basis of public as well as private care of health. Every step forward in this direction is a gain to human working power and human welfare. There can be no higher object for human society than to obtain this gain. But this basis is not reached upon small, limited districts. The laws of life know no politico-geographical boundaries. If the object sought is to be reached, then must *states* and *nationalities* join hands, fully believing that this is one of the most important international efforts in the interests of the state and of science.

. . . . "The plans to be devised must not only take into consideration local circumstances and arrangements, but, actuated by an appreciation of the international relations, must be so prepared as to form a basis which by its excellence and fitness will receive the approbation of other nations and awaken their cordial endeavors in like manner; and yet again, they must contain such a degree of accommodation to arrangements already in existence that advanced nations and states shall willingly join the work without being forced to build up anew instead of making additions and improvements easily to be attained. The difficulty of successfully solving such a problem is very great. It is made the more difficult, as the state on one side, and science on the other, makes demands upon mortality statistics; and it is extremely difficult, generally, in mapping out such plans, to keep the correct boundary between satisfactory simplicity and desirable completeness. But these difficulties lose much of their importance when compared with the facts which have already been given to us by larger or smaller state territories."[1]

Plainly enough there are numerous points to be considered in devising a plan for suitable records of death. They may be grouped in three classes:

(1.) Uniformity of methods of record as well as of nomenclature of causes of deaths.

(2.) Universality in regard to extent of areas of administration and uniformity of registration; that is to say, the nationality and *internationality* of uniformity in state methods of mortality records; the practical uniformity in nomenclature, or of equivalent terms in nosology, being one of the essential conditions for obtaining a basis of accurate comparison and scientific deduction in the records of mortality in various states and countries.

(3.) Standards of accuracy, or verification of the causes of death that shall be universally adapted to exclude all trivial and non-essential matters from the certified record of any death, and be competent to make a reasonably correct record of the actual and essential causes of every death.

The conditions requisite to a faithful official and medical certification or public record of a death, and its cause or causes, are essentially the same in city and hamlet, in old states and new territories, though the facilities for securing a correct medical certificate may be always and without delay near at hand in a city, while in rural districts such a thoroughly scientific certification may be sometimes impossible, and only an *official judgment* or judicial and logical statement of the causes of death be obtainable in the exceptional instances. Such a judgment, however, being based upon a record of facts and circumstances, it must serve as an equivalent for a medical or expert certificate. But these exceptional cases are so few that their de-

[1] *Plan for Mortality Statistics in Germany.* By Dr. F. W. Beneke, Professor Pathological Anatomy and General Pathology, University of Marburg, 1875.

fectiveness cannot seriously impair the value of the whole mass of records in which they may be gathered. This point is mentioned here in defense of the law or regulations under which the few records of deaths in remote places, where no medical certification is practicable, may be entered in the mortality register, after the best of obtainable evidence has been duly submitted to the authorities who are charged with the duty of the registration.

Numerical completeness and entire accuracy of the individual records of mortality can and certainly should be attained. The only errors and deficiencies in the mortuary registry that cannot be overcome are those which relate to the real and occasionally obscure causes of death. These *defects must be reduced to the lowest minimum* by methods that medical science provides, and which the laws make official; while the sources of error and incompleteness in the numerical and individual records should be wholly prevented by means of regulations and local supervision concerning the duties which are required for the interests of society, as well as for the rights and the correctness of the historical and family records represented in deceased persons. The whole subject before us, therefore, comprises under two general requirements — namely, that of (1) *actual completeness* and (2) that of *competent and faithful verification* of records of death — certain conditions to be officially organized and provided in every State and in the several registration districts of each State, whether such districts are separate municipalities, towns, or counties. These may be enumerated as follows: —

1. The reporting and verification of the *death itself.*

2. Verification of *the cause of the death,* — medically when possible, — and by formal description of the mode and circumstances in all cases.

3. The authenticated reporting of the death to the person who is responsible for the local registry of mortality.

4. The recording and issuing of a permit to inter the corpse after the foregoing acts of verification and record (by certificates).

5. Such continual special uses of the collected records in each registration district and State as shall inform and satisfy the people regarding the necessity and practical value of the registration law and its methods.

6. The *central organization of methods* for securing complete and well-verified records of mortality, and the supervision of the state office of vital statistics.

Experience has abundantly proved that one of the first and most essential aids to popular appreciation and public support of methods and duties of vital registration consists in the very fact of *precision and completeness in the forms* of the records required by law. All reasonable people have such an instinctive appreciation of the sacredness of a human life, and of the rights of family and individual honor, and of truthful records of lineage, that the completeness and definiteness of the individual ethnological statement in the death-certificate directly promotes willing compliance with the law in regard to this part of the mortuary registry. No registry of death will be respected and popularly sustained which barely records the old church-yard inscription: "Born on such a day, and died on such another."

This suggestion concerning the importance of precision and completeness can now be extended to a new feature of the influence and value of interstate uniformity and national completeness and a recognized uniformity and completeness of an *international* kind. The latter is to be attained only through the former kinds of agreement and completeness, while *success* in securing an inter-state or national, and possibly an international, system of vital registry will probably be determined by the adoption by us in the American States — where all our methods are *sure soon to be greatly modified* — of a system which shall be both *complete and simple;* that is to say, as complete and perfect as practicable, and so direct and simple in its methods and duties as to be satisfactory to the people and the officials concerned.

The public always requires promptitude, directness, and an obvious usefulness in the methods and requirements of any bureau service. Scientific truth, fullness of record, and the uses of individual history have their claims in every death-record, and yet at the same time must conform to the demands of that public sentiment which opposes arbitrary bureaucratic methods. It is necessary to bear in mind the different modes of local government and the peculiarities of social usages in the various States when we propose that there shall be uniformity in the system of public records of mortality. Uniformity of results and of significant values, a near approximation to uniformity of nomenclature as may be practicable, are the objects sought. Are these objects attainable? Yes, in the opinion of the leading vital statisticians and public health authorities, they are. The German Empire is at present settling this for all the German-speaking states; while Belgium, Holland, France, Italy, Sweden, and England, and all English-speaking people, are consenting to the propositions of their respective national leaders in vital statistics.

The fact that no State in the Union, none in all America, has a satisfactory or even a numerically complete registry of deaths or of births is favorable to the adoption of a system which will harmonize with the best results of European registration, for in all the States of our Union a satisfactory degree of uniformity can be brought about.

The difficulties we may meet in this effort to secure uniformity are the same as are now being overcome in the German states. Professor Beneke remarks, in a recent report on this work in the German Empire: . . . . "The doubts and the opposition to mortality statistics are but too well known to me. There can be no question that in our German fatherland, too, there are single districts in which the want of physicians, as well as the scattered location of the population, makes all expectation of solid advance as yet but illusory. In the Prussian district of Koslin there is, in some districts of from five to ten square miles, but one physician, with 150 people to the square mile. But we cannot consider the exception as the rule, and it does not form a criterion in matters where questions are at stake that can be answered by observing vast masses, and numbers which do not lose in value by the exclusion of a small percentage. There can be no question, too, that even with the presence of a sufficient number of physicians errors in the diagnosis of the causes of death are unavoidable, and that in country districts we may have to accept the statements of laymen in regard to causes of death. But this unavoidable source of error is, in its consequences, less important than it appears on first view, as on the one side the laymen can give a satisfactory statement of a number of causes of death, and on the other the locality or district from which these unreliable statements come are always known, and can, in making up the results of the registry, be excluded. If we should be prevented from solving great problems by these and similar difficulties, we would have to oppose railroads because all neighborhood roads cannot be transformed into railroad routes, or we would cease researches in astronomy because all stars cannot be recognized and their relations to known stars cannot be deciphered. . . . . The possibility of a system of mortality statistics satisfying the requirements of the state as well as of science, and of a system which will embrace not only smaller geographical districts, but the whole circuit of civilized nations, being thus illustrated, it needs to be especially stated that only the state by its legislation and by its methods can insure a realization of this possibility."

The official machinery (of the State) by which the vital statistics are collected and registered must not be ponderous or very expensive; yet it is obviously expedient to leave to the municipalities which have efficient sanitary services all the discretionary power they please to exercise for securing information concerning causes and circumstances of mortality and of diseases. Such local authorities must, of course, fill up all the requirements of the statutes if they administer for the State, but whatever is obtained for the local uses would not necessarily be reported to the central office and department of vital statistics of the State. This remark presupposes the fact that the State should make use of local aids, and, in all reasonable ways, conform its local work to local facilities so far as such flexibility of its methods may promote the value and completeness of the records, and add to the usefulness and economy of the registration. Objectionable as some of the features of partisan political administration are, it is inexpedient to multiply the expensive official machinery in our cities. A wise and efficient general of an army will use successfully all the effective forces that are brought under his command. The central authority — the State Registry and Statistical Department — must be empowered to use all the resources it finds already available for the registration service. City departments of public health should be required by statute to give whatever aid they can under their respective local government acts to maintain the State laws for registering the causes of death, as well as for registering births and still-births. So far we recognize the mutual relations of the public health authorities and the State system of mortuary registration. At a later stage in this report it will be shown that as State Boards of Health and local sanitary government assume a thoroughly organized condition, the records of causes of mortality and the registry of prevailing diseases will necessarily be vested in their department of public service. It will be desirable and truly fortunate if the strongest of the State Boards of Health and the most efficient of city health departments shall soon assume the *official responsibility* of mortuary registration. The cities of New York, Brooklyn, Philadelphia, Boston, Providence, Washington, Chicago, Cincinnati, St. Louis, and New Orleans would be crippled in most important resources of sanitary information if the returns of mortality and the control of the registry of deaths were withdrawn from them. The Health Department of Boston has been constrained to assume this branch of service.

We proceed now to consider some essential details of a plan for securing uniformity, verification, completeness, and accuracy in the records of death.

In regard to *uniformity*, it is necessary that the State shall require of the designated local recording officers that one and the same *form of certificates* of death shall be filled out for filing in the central office of the State registry. This will be necessary, whatever may be the more elaborate forms employed in particular cities or at particular periods. The simple, but officially verified certificate (usually a mere *transcript* of the essential parts of the primary certificate) should recite complete answers to the series of questions which the public register of deaths requires to be answered. These questions relate to the person and family, — a concise anthropological record, on which depend the questions of lineage and personal and family identity, etc., the residence, and certain local circumstances of the death.[1] The facts which are verified concerning causes of death ought always to be certified by the initials of the authorized registering officer, under whose hand the original certificate was passed onward to the Burial Permit Record and the Local Mortuary Register. Nothing should be *estimated* or "*doctored*" in the State Registry Office. The local officers of registration alone should revise and correct errors in regard to the causes of death, except, of course, such errors as may admit of judicial and literal correction, as will occur in certain deaths by violence, poisons, epidemic maladies, etc.

The certifying and verification. — The professional attendant upon a dying person is the first source of responsible information concerning the death so witnessed; but when no such attendant and witness is present at a death, the householder or other responsible person who witnesses or is present upon the premises where the death occurs should certify in a prescribed manner the facts known or witnessed; if no person is present or witnessed, and can so certify, the case becomes necessarily one for judicial inquiry and record, and from that source the final certificate must issue.

Now arises the question, *Can all this be secured in every portion of the country?*

The reply to this question will be easy in any State that has an efficient central Department of Vital Statistics; but the prompt and satisfactory reporting and primary certification will depend upon the organization of local authority and the means for administering the laws for registration.

The key to *complete success* in obtaining the reports, and whatever can at once be certified in any and all deaths, is the burial permit, and the re-

[1] See Part 1st of Form A, page 16.

quirement of a record upon which to grant and issue such a permission. The burial permit and its registry should be made a prerequisite to the interment of any corpse. The only cases to fail of being so permitted to be interred will be simply the homeless or certain exceptional cases that neither the observation of the people nor any system of judicial inquest can prevent perishing and decaying in the wilderness or waters, and being recorded, if ever found, as unknown dead, or dead from unknown causes. The coroners' cases, the country over, may be even less numerous under an efficient system of certifying and registry of deaths than they now are. Eventually the judicial questions concerning violent deaths will be treated more effectually than they now are ; but in the first steps for securing a uniform system of registration there is no necessity for attempting to overthrow the coroners. They are participants in a bad political system. We neither need their help nor need trespass on their claims. The people will rectify their old laws when they see what burdens and wrongs are imposed by them. Certainly the organization of the duties of vital registration must not wait on all the amendments of State constitutions and of statutes which alone can wholly change the practice and relations of coroners. Even in England and in the city of New York we witness great abuses and incompetence in the services of coroners, yet see remarkably complete registration of mortality; while in Massachusetts the people have aroused to the duty of terminating the abuses and stupid proceedings of the old system of coroners' inquests, and have superseded them by *expert medical examiners.*

The permit for an interment must ever be the key to prompt compliance with the law for reporting, certifying, and proving or verifying the deaths, in all places ; and by giving effect to the general provision or rule under the statute which requires that competent medical verification and certifying shall be had wherever practicable, experience will prove that the exceptions to that rule may be so managed by the registering authorities as to make all the essential parts of the records quite complete. The medical conclusions respecting the true causes of death can be trusted when the circumstantial history of the sickness or injuries and the mode of dying are described in a prescribed manner and in accordance with the forms prepared for use where educated medical attendants cannot be consulted. This matter is correctly set forth in the remarks we have already quoted from Professor Beneke, of Germany. The central intelligence which inspires and shapes the returns of records from all sections of the State can bring these exceptional and somewhat defective individual returns from sparsely settled and neglected districts into a proper form for correct registration, though, like the death records of the Mongolian portion of the population in San Francisco, the exceptional records will be worthy of a separate analysis and study. Plainly enough the uniformity of records of death in a State will depend essentially upon the central intelligence, the State Department of Vital Statistics. The central intelligence and authority being secured in *each State*, its own records can be rendered complete and uniform. The several States can secure uniformity and completeness for the registration throughout the Union, and the only national system of vital statistics which can at present be made successful, by securing unity of plan and this practicable method of agreement between the State officers of registration. There can be and there must be unity in the diversity of the details of the administration of the registry laws. Uniformity may never be practicable in the registry of causes of death in that absolute sense which the mere statistician might wish, but the most essential kind of uniformity that is useful in hygienic and medical studies can be attained by simpler and more flexible means than the absoluteness of mere bureaucratic authority can secure. The experience of the English Registry Service has proved that the central intelligence, represented in Dr. William Farr and an able staff of assistants, in that service has secured for England the preëminence of its records of mortality. The chief defect of that model registry service is confessed to consist in the frequent instances of incompetency of sub-registering officers. The registrar-general is not a medically educated man. Dr. Farr is *not the chief;* he is the compiler and student of the "General Register Office." In the United States we ought to secure for the central service of the registry system both medical and general intelligence, specially adapted to the aid which physicians and the people need to enable them to make the best returns possible for the public registry. Such good work as the State Board of Health of Michigan has done through its secretary, Dr. H. B. Baker, and such as the State Board of Georgia has begun, in giving a basis for definiteness and general uniformity within the State, proves that the central intelligence can be obtained in a very economical way in any State. That is to say, a well-organized State Board of Health necessarily calls to its own service the special intelligence and zeal which are necessary for the best direction of the registration of the causes of mortality.

The medical profession must be depended upon for the chief service and aid necessary for accurate and complete registration of causes of mortality; but the merely personal and family records — personal description and history — should be obtained from the family, the next of kin, and by means of strictly obligatory regulations of burial. The interment of the dead should, in every place, be regulated and permitted by law. *The license to bury* (the license of sextons, where there are sextons), and the designation and permitting of such other persons as should be permitted to undertake this service of burial, is an essential prerequisite for the general success of the regulations *by which the records of death* shall be secured and registered.

The successful maintenance of an adequate system of records of mortality depends upon the official existence of a *central intelligence*, a bureau or department (in which shall be certainly one *expert*) in each State for the purpose of directing the methods and perfecting the duties of registration of mortality, and generally to supervise the registry of the three branches of vital statistics. The successful inauguration of the improved registration which each State requires may be secured by a statute to provide the best methods that can be successfully enforced throughout the State, under the *highest intelligence* and most *expert experience* which can be commanded.

The State Board of Health, in the States that have such an organization, seems to be the most natural and competent source of the expert and centralized official supervision of the vital registration. Certainly this is the fact concerning the records of mortality. The *uniformity* that is *attainable* and *most desirable* must be attained by the conference and coöperation of the chief or central officers in charge of the best State and city systems of registry.

The uniformity of nomenclature and of the forms essential in records of mortality is already an assured fact, which will almost certainly be realized as rapidly and completely as the formal organization of registry in the States makes progress. Those States in the Union that adopt a good and successful system of vital registry will directly promote the most practicable kind of uniformity in the results of general registration. The national government at the same time has special opportunities and obligations for promoting uniformity and universality of registration; for not only in the army and navy, but in other departments of public service, the complete and perfect registry and official returns of mortality and its causes, and of births and marriages, and even of prevailing diseases, may properly be required under a national law. The enumerations of each decennial census henceforth should require the preparation of such schemes of returns of mortality as shall secure *verified* statements from competent medical men in every district in regard to the actual and classified causes of death. The army and navy medical departments have begun their part of the national duty, and there will be no great difficulty in securing before long a national system of registration, if the States and the national government respectively do their obvious duty in this matter.

Having in view this duty of the coöperation of Congress and the States, the following resolution was adopted by this Association at its Third Annual Meeting: —

"*Resolved*, That the Executive Committee is hereby instructed to memorialize the Congress of the United States, in the name of this Association, in favor of such legislation as will bring about a proper coöperation between the general government of the United States and the several State governments for a uniform and efficient system of the registry of deaths, births, and marriages of the population."

This Association is now invited to lead in a voluntary council of registering officers of vital statistics, and others duly designated. This invitation is respectfully submitted to this meeting. The American Social Science Association having requested the writer of this paper to submit a report on uniform systems of registration of births, marriages, and deaths, for the United States, the *conclusions* and *resolutions* quoted below were adopted by that Association. That report was originally called forth at the suggestion of Dr. William Farr, of the General Registry Office, England. The invitation thus extended to this body by the Social Science Assocition is accompanied by the following statement: —

"*Conclusions*. A committee should be appointed by the chief sanitary authority and the governor in each of the United States to confer upon the questions which relate to the institution of a good and uniform system of registration of births, marriages, and deaths. The State Board of Health and the governor in each State that has such a board (and the governor's selection of one of the ablest public hygienists and vital statisticians in each State that has no such board of health) would readily arrange the general committee for conference. Such committee should be appointed with instructions and power to report a suitable plan and the forms of law and amendments of particular statutes, to secure a good and practicable scheme of registration. The same general committee should be instructed to open (and conduct on their part) such international correspondence and conference as may be practicable and in the line of their duty, with reference to uniformity of systems and of nomenclature in the registration of mortality. The formation of such a general committee for conference in the United States will need to be called for by several organized bodies, which, like the American Social Science Association, have a legitimate interest in, or responsibility for, the establishment of an effective and uniform system of vital registration. That this Association is especially called upon to take an active part in the formation of such a committee is obvious. The suggestive letter from Dr. William Farr [1] to the secretary of this Association, on the necessity of a complete and well-devised registration of births in the United States, urges this Association to take such action.

"To give a suitable direction to the efforts here proposed, the following resolutions are submitted: —

"*Resolved*, That a committee or representatives of the American Social Science Association be appointed to confer with the Superintendent of the Ninth National Census, and the representatives who may during the present year be appointed by the American Public Health Association, the State Boards of Health, the medical departments of the United States army, navy, and marine hospital service, and other expert vital statisticians whom said representatives shall call into their council, with reference to devising and procuring a thoroughly efficient and uniform system of registration of births, marriages, and deaths, and causes of mortality in all States in the Union.

"*Resolved*, That the Registrar-general of England, and Dr. William Farr, of his office; Dr. Engel and the officers at the head of vital registration in the Department of Statistics, which he directs in the States of Germany; Professor Beneke, of Marburg, and Dr. Sander, of the 'German Association of Public Health Care,' be consulted in regard to this work."

[1] *Extract from Dr. Farr's Letter.* — "I would willingly send you a paper on the interest the whole world feels in accurate returns of the births, deaths, and marriages in the United States, with full particulars, such as your younger sister, Australia, secures. This you can only get by *one uniform system* of registration for the whole republic. . . . . I speak from long experience, and feel that your sanitary and social progress very much depends on a registration as general and uniform as your census. . . . .

"By obtaining an accurate record of births (with age of parents), marriages (with age) and of deaths, with causes, you will confer the greatest benefit on your country. . . . .

"W. FARR.

"LONDON, *March* 2, 1875."

The president of the Social Science Association appointed, as its committee, for the purposes here specified, Dr. Elisha Harris, of New York, and Dr. Henry B. Baker, secretary State Board of Health and registrar of vital statistics of Michigan.

The action here suggested is respectfully commended to the consideration of this Association, and the following statement, with some appended outlines concerning records of mortality, are submitted.

The practical relations of well-kept and complete records of mortality to the correct estimation of sanitary experience, and of the most essential questions connected with the causation and prevention of diseases and premature death are so important, that sanitary authorities, and the wise and effectual application of public health measures, demand that the mortality registration shall be both complete and accurate. The fact is that the death-rate per thousand living people, fluctuates from eleven to forty, fifty, sixty, and even eighty per annum, in different places, the fluctuations being directly chargeable to the local, the domestic, personal, and to certain avoidable vital and unfortunate physiological conditions of the populations who present these variations in excess of a minimum rate of mortality. The population of London has suffered yearly death-rates equal to eighty, sixty, forty, thirty, and now, less than twenty-four to the thousand, these variations being due to the sanitary conditions under which the people lived, and the vital and constitutional vigor of the successive generations. It is a fact in the history of human experience, that from ten to seventeen deaths will inevitably occur in the best regulated and most favored community of families; at the same time it is a matter of repeated observation, that from forty to sixty per cent. of the entire mortality, in particular cities and districts, and among entire classes of inhabitants in the State, is charged to the infants under five years of age. On the other hand, there are numerous towns and extensive districts, in which the death-rate steadily remains less than twenty to the thousand inhabitants, and in which even the infants enjoy double, triple, and quadruple greater probability of surviving to adult years than do the children in certain great cities or among certain degraded people. The proper understanding of the great governing causes of the premature mortality, on the one hand, and of security to life and vigor, on the other, the unfolding and practical application of the laws of health, and of national prosperity and social welfare, and the true basis of wise sanitary administration in communities and States alike demand the complete and faithful registration of vital statistics.

There are economic and social problems and certain of the great national and social questions in our country which require that there shall be a complete and accurate public registration of births and deaths, and there are intimate relationships of human vitality and soundness of manhood to the prevailing kind of destructive disease and premature mortality which cannot be understood and adequately controlled without coördinating the study of the records of mortality and its causes, with those of birth, and of marriage even. There is special necessity for completeness and accuracy as well as for reasonable uniformity in the public records of the births and deaths throughout every State in the Union, with uniform national results which shall be adapted to secure harmonious or comparable international annual summaries in each branch of vital registration. Being now advocated by the most enlightened sanitary and social economists and statistical authorities in all the civilized nations, this Association will do good service to the public by pressing to practical results this recommendation of thoroughness and uniformity in the registry of vital statistics. It is socially and politically wrong and discreditable for our American States longer to neglect the thorough organization of this public duty.

Before the national census of 1880 is commenced, all of the States ought to have a good system of vital statistics organized and in harmonious operation, contributing comparable and numerically complete results. If this were the case, the last two decades in the present century would have such records of the population as will be most needed by the public economist and all students of human welfare in our country. The United States government might promote and help perfect the inter-State system of vital statistics by organizing model examples of such a system in the army and navy and in all territorial governments.

It certainly is not creditable to a great nation like ours that there is no system of registration of births, marriages, and deaths by which the growth and social condition of the people of all the States may be publicly announced at stated periods. The decennial census enumeration of the national population can never be made satisfactorily complete and accurate as respects the births, the deaths, and the causes of death, unless there is a faithful and complete public registration of them in the several States and Territories. It is unworthy of our nation, as it is of each of the States and Territories it comprises, that the vital statistics, and an exact statement of the birth-rates, marriage-rates, and death-rates, year by year, cannot be entered and studied with those of other civilized people. The following schedule, which we borrow from the English registrar-general, ought to have included a summary from these States and the Union; but the records do not yet exist. Another decade of neglect to adopt an effectual system of registration in the United States would be greatly to the discredit of the intelligence and public spirit of American citizens.

Summary of Births, Marriages, and Deaths, and the rates, per one thousand inhabitants, of each, yearly (the last year in which the records have been published).

Country.	Estimated Population.	Total Births.	Marriages. (Persons.)	Deaths.	Birth-rate per 1,000.	Marriage-rate.	Death-rate per 1,000 inhabitants.
England and Wales	23,648,609	854,956	404,020	526,632	36.2	17.01	22.3
Denmark	1,860,600	57,278	30,520	36,998	30.8	16.4	19.9
Sweden	4,341,559	133,249	62,844	87,760	30.9	14.5	20.3
Austria	21,169,341	849,678	378,034	662,929	40.1	17.9	31.3
Prussia	25,185,522	1,009,977	489,546	650,578	40.1	19.4	25.8
Holland	3,767,263	176,072	62,706	85,069	36.1	16.6	22.6
France	36,397,000	953,510	601,653	784,856	26.2	16.5	21.6
Spain	16,935,613	599,786	211,086	509,669	35.4	12.5	30.1
Italy	27,289,958	951,658	415,994	827,253	34.9	15.2	30.3

Already in England the sanitarily improved districts are separately studied with reference to new and more favorable rates of life assurance.

Dr. Farr's new "Life Tables for the Healthy Districts of England," present this matter in a most practical way. Grouping sixty-three of the healthy towns and districts in England, and interpreting the death-rates at each age of the living inhabitants, and comparing with birth-rates and yearly increase of population, "the chance of life" in those districts is found to be vastly greater than that of the average population of the whole country. The concrete fact in regard to this matter is this: "Persons in the healthy districts of England who reach the age of twenty years will, upon an average, survive $43\frac{45}{100}$ years, or to the age of $63\frac{45}{100}$, while in the general average chance of life for the whole of England, the persons who reach twenty years of age will only survive $25\frac{82}{100}$ years, or to be $45\frac{82}{100}$ years old. In his review of the English decennial census for 1871, Dr. Farr remarks: "The analysis of the causes of the mortality renders it still further certain, that the actual mortality of the country can be reduced. Many of the destroyers are visible, and can be controlled by individuals, by companies, and by corporate bodies, such as explosions in coal mines, drowning in crazy ships, railway collisions, poisonings, impurities of water, pernicious dirts, floating dusts, zymotic contagions, crowdings in lodgings, mismanagements of children, neglects of the sick, and abandonments of the helpless or of the aged poor. Furthermore, including the London districts of Hampstead, there are fifty-four large tracts of England and Wales which actualy experience a mortality at the rate of only seventeen per thousand, less by five than the average mortality per thousand of the whole country, less by ten than in nine districts, and less by twenty-two than the mortality reigning for ten years in Liverpool. Now the healthy districts have a salubrious soil, and supply the inhabitants with waters generally free from organic impurities. The people are by no means wealthy; the great mass of them are laborers and work people on low wages, whose families get few luxuries, and very rarely taste animal food. Their cottages are clean, but are sometimes crowded, and impurities abound; the sanitary shortcomings are palpable. It will not, therefore, be pitching the standard of health too high to assert that any excess of mortality in English districts, over seventeen annual deaths to every thousand living, is an excess not due to the mortality incident to human nature, but to foreign causes to be repelled, and by hygienic expedients conquered."

The growth and movements of the population of the nation or a State, are matters of public importance, and without accurate and detailed knowledge of them, the political economist and the public hygienist will be astray in some of the most important studies that concern the welfare of the people. It certainly is practicable to secure a basis for uniformity and completeness, and even for verified correctness of records of mortality and its causes in all the States of our country. While securing this great result, the system of registration of births and marriages in each State may readily be placed on a sound basis, whether it is in all instances brought under the same personal supervision as that of the death records or not;

but as civilization advances and social science and religion gain greater and greater ascendency over the minds of the people, the excessive increase of pauperized and dependent classes, and the normal and healthy rates of increase of the more favored portions of every community, will be vastly important factors in the yearly history of human life and the public health. These scientific purposes and uses of vital registration will then be seen to be the most permanently valuable of all, while the immediate uses of the public records of each of the three signal epochs and its special circumstances in human lives, shall serve the social, moral, and economic objects for which, in the public estimation and as an immediate duty to society and individuals, each of the three branches of vital registration must be maintained.

The American Public Health Association has steadily advocated the most thorough organization of the duties of vital registration upon a basis of practicable uniformity. The time seems now to have arrived for successfully urging each State to perfect its own system, and at the same time to organize its methods and forms for this department of records in harmony with the best standards, so that all the results of the registration shall be comparable and well adapted to promote the interests of hygiene and social science.

Death, with its infinitely varied causes, is not completely described and most usefully studied until the great groups of the agencies that war against life and health are recognized and brought into the systematic account with the records of mortality, and until, indeed, the public records of marriage and birth in the successive generations, and the social, industrial, and general biological circumstances of the populations in communities and States are correspondingly registered and brought under review. The practical significance of death-rates, the economy of sanitary measures, the value of family or race culture, and of hereditary or constitutional health and the improvement of human welfare, will be correctly understood just in proportion as the records of generations of people in all circumstances, and individuals in all these relations, are brought under correct methods of record and study of their life-history, from the cradle to the grave. The true significance of the records of causes of death will ever require the concurrent public registration of birth and marriage. But the death roll must not fail to be made up officially, nor should the individual certificates of each death fail to be faithfully filled out and verified wherever deaths occur, whether there has yet been organized any system of registry of births and marriages or not. The interests of the living, duty to those who die, and the ends of justice and order in communities alike require that the public records of mortality shall be complete and faithful in every place and among all classes of people.

To secure this object it is necessary that —

First. Every death shall be certified by persons who witnessed, or who, as the authorized officials or physicians, shall certify the fact and the prescribed statement of the circumstances of the death.

Second. That the identification of the deceased person and the description of the essential cause or causes, and the circumstances of the death, shall be verified in a formal and authentic manner by the medical attendants and other persons designated in the laws relating to deaths and interments.

Third. That every burial of a human being should be preceded and authorized by a written permit, having a prescribed form, and being dependent on the verified and fully certified statements in the nature of a certificate of death, ready for official registry.

Fourth. The permit to bury human remains should be given and allowed to officially authorized persons only, whether they be sextons and undertakers, or simply men who must do this service for the dead as an unusual or occasional act. The "burial permit" should be given strictly for the transportation by a particular carrier of the corpse onward to a designated place, and every such permit should be registered and the record of it be preserved by the authorized person who issues it.

Fifth. The medical and all official certificates of causes of death, without which interments should not be permitted, should employ the nomenclature most approved by the medical profession at the present time, and in whatever cases it is not practicable to employ such precise terms, the circumstantial record of the mode and causes of the death should be carefully certified. Even the returns made by coroners and magistrates in the exceptional and judicial cases should conform to this just and necessary rule.

In conclusion, there is no one fact more important for guiding the advocates of correct, uniform, and complete registration of mortality than that which was stated in the first pages of this report, namely, that the leading object of such registration being to promote the science and art of healthy living and to serve the interests of society, we must strive to attain all desirable completeness by methods which shall have the merit of satisfactory simplicity. This can be accomplished only by a faithful system of verification of the circumstances and facts in every death and by the formal authorization of every interment, the central intelligence which should direct and advise concerning the mortality registry in each State being responsible for the instructions and inter-State coöperation which shall secure thorough accuracy and general uniformity in the registration of causes of death.

On motion of Dr. H. N. Hewitt, Secretary of the State Board of Health of Minnesota, it was unanimously—

Resolved, That the report and conclusions submitted by Dr. Harris be accepted and immediately printed for the use of the Association, and that copies be furnished to all members and officers of the State Boards of Health.

[FORM A.]

CERTIFICATE OF DEATH.

PART FIRST.

1. *Full Name of Deceased* (If an infant not named, give parents' names.) ______
2. *Age* ______ *years* ______ *months* ______ *days.* *Color* ______
3. *Single, Married, Widow, or Widower* (Erase words not required in this line.) 4. *Occupation* ______
5. *Birthplace* (State or Country.) ______ (How long in the United States, if of foreign birth.) ______
6. *How long resident in this city* ______
7. *Father's Name and Birthplace* ______ (State or Country.) ______
8. *Mother's Name and Birthplace* ______ (State or Country.) ______
9. *Place of Death* [1] (If an Institution, state the name.) ______
10. *I hereby report this* Death, *and certify that the foregoing statements are true according to the best of my knowledge.*

(Signature and residence of reporter.) ______

PART SECOND.

11. I hereby Certify, *That I attended the deceased from* ______ 187 , *to* ______ 187 , *that I last saw* ______ *alive on the* ______ *day of* ______ 187 , *that* ______ *died on the* ______ *day of* ______ 187 , *about* ______ *o'clock,* *M., and that the*

12. *Cause of Death* [2] *was* ______ (Complications.) ______

______ (Duration of Complication.) ______

13. *Duration of Disease* ______

______ *M. D.*

Residence ______

Nº. of Burial Permit ______ *Date* ______ 187 .

Place of Burial ______

Name and Residence of Undertaker ______

[1] City — No., Street, and Ward ; — same in towns that have them ; — give name of township or precinct.

[2] State primary and immediate cause of death, and examine the list of diseases and special inquiries, and the law pertaining to coroner's inquests, accompanying these blank forms.

AMERICAN PUBLIC HEALTH ASSOCIATION.

SIXTH ANNUAL MEETING.

RICHMOND, NOVEMBER 19–22, 1878.

The Sixth Annual Meeting of the American Public Health Association, held in Mozart Hall, in the city of Richmond, Va., was called to order by the President, Dr. Elisha Harris, of New York, at half-past seven o'clock, who announced that His Excellency Governor Holliday would preside during the evening. Prayer was then offered by Rev. Joshua Peterkin, D. D., after which Dr. S. P. Moore, of Richmond, introduced Governor Holliday.

I.

ADDRESS OF WELCOME.

BY HIS EXCELLENCY F. W. M. HOLLIDAY,
Governor of Virginia.

GENTLEMEN OF THE AMERICAN PUBLIC HEALTH ASSOCIATION, — In the name of the people of Richmond I bid you welcome to the hospitalities of the city. You are welcomed coming from every part of the country not only on account of your private standing and worth, but also as members of a society organized for the purpose of elevating the grade and promoting the happiness of the human species. This is a noble work and demands the profoundest sympathy of all men. In it are involved incalculable issues. There never has been a time when the health of the body and mind was not needed to wrestle successfully with the aims and objects of life. Each is indispensable to the other. The mind in a rickety body cannot without difficulty preserve its integrity. A sound body inhabited by an unsound mind is soon broken into a wreck or driven madly to the injury or ruin of others. I need not say to an audience of such special culture as this, that the hereditary consequences of either are more far-reaching and fearful than the original taint. Nor has there ever been a period in history when this work was so imperatively demanded as now. Man has under his control, not only the powers of his own mind and body, but the mighty forces of nature. The true spirit of investigation has started a new era, and every day is thronged with the coming of strange powers which have been hitherto unknown, or are finding new modes of appliance, or seeking new fields of operation. Indeed, so rapidly do they succeed one another that each is only the wonder of an hour to be followed by something more important or more curious. We seem to be living amid the play of real forces and agencies, more gorgeous and more wonderful than were ever portrayed by the most subtle and weird sport of the eastern imagination. Were they grouped and artistically arranged in story, no one of the Arabian Nights would approximate it in interest and beauty. In consequence of this the very atmosphere is filled with thoughts, each struggling to be heard, and pressing with amazing rapidity and energy upon the human intellect. The student can no longer sit in his study and quietly spend days and weeks, months and years, in meditation, awaiting the gentle coming of ideas, welcoming their advent and helping their departure as a host does the friendly and not too frequent guest. But they now crowd about the door and demand an audience, so that unless the mind is well ordered it will not know how to treat them in their turn.

The intellect cannot stand the pressure of such times as these in which we live unless it is enthroned in a healthy body. It gives way before the mighty hosts as they come trooping from every field of nature's wide domain and array themselves for grand review before the bewildered understanding. If it has not strength, — the "sana mens in sano corpore," — it is not hard to predict the result. It seems to me that there is hardly a daily paper that does not contain the news of some man, strong in good deeds, and valiant for the truth, struck down by overwork in the very prime of life and in the midst of his labors. For this is eminently an age of action and the active forces are those which are mostly in demand. The contemplative may exist with a feeble physical organization. The active rarely if ever can. Few great men have ever lived who had not fine healthy physiques. Running back over the past, this will be confirmed by history, and never more fully than now throughout the whole range of business. If, then, we would educate for these times, it is important every way for us to consider how we can have healthy minds and bodies upon which to operate.

Thus in a general way is shown the vital importance of the work of such an association as this. It is of perpetual application, and goes through every department of life and penetrates every pursuit. Health is normal; disease abnormal. Health is the happy co-working of the laws of our being with the laws of our environments — to adopt the significant terms of the evolutionists — and life, the continuous adjustment of internal to external relations. It is only by knowledge that we can happily accomplish this. It is only by obedience to nature that we can hope to subjugate her, and like the magician, evoke her marvelous forces from their hiding-places, and send them forth whithersoever we will to do our bidding. Not that I believe, gentlemen, that the sum total of education is the study of nature's material laws; not that I believe that man is but the cap-stone of the evolution pyramid; and whilst he views with complacency the gradations of life below him, he is forbid to lift his longing brow, that it may be fanned by the breezes of immortality. Let us value this body and be faithful to it, not only that it may do its work as a material organization, but that it may be a fit temple for the indwelling of the immortal spirit.

I say this much because public health has a vast deal to do with public morals. Immorality is the most fatal blow that can be struck at public health, and I believe that the only real and abiding foundation of morals is religion, whence springs that sense of obligation which has its germ in the very centre of our spiritual nature, and, like faith, is the source of our greatest strength.

Whilst there are considerations which must ever and permanently engage your attention, and may be regarded as of daily and constant experience, there are others that come unheralded in the shape of myriad-form disease. This often falls like the black shadow of the destroying angel's wing. We cannot tell whence it comes or whither it goes. We only know that it leaves behind it sorrow and death. Such a visitation has at times befallen large tracts of our own and other countries, and the destruction has been incalculable. One of the great and beneficent objects of this Association is to investigate causes, and, if possible, find remedies. This alone would justify such a convention as I now see before and around me. Indeed, I am informed that the prime object of this meeting is to find out something about the dreadful plague that has but yesterday swept with its bloody scythe the fairest portion of our land. This is a noble work, worthy of such men. God moves in a mysterious way, and we cannot follow the silent stately steppings of His Providence. He makes weak things to confound the wise. He makes sore afflictions work great blessings. And whilst men and women in sorrow were digging graves to bury their loved ones, their brethren and sisters in other sections were, from the depths of their hearts, filling them with the sweetest of Christian charities — which, my friends, will bloom perennially out of those graves, filling the air with their aroma, and worth a thousand times more than the declarations of politicians and the professions of philanthropists.

But, gentlemen, beyond the immediate objects of the Society, other ends will be attained by your gathering. Coming from every section of our common country, bringing your learning and your culture, your experience and your earnestness, you will imbibe that gentleness and affection which are the very genius of unity. And when you go to your homes, wherever they may be, you will carry with you that feeling of fellowship that is stronger than political and sectional bonds. Here in this beautiful city, which was lately the heart of convulsion ; here, where honest, fearless men and women strove even unto death ; here, where suffering of warfare was endured that will never be known till the great future when all hearts will be revealed ; here, where prayers were offered that need not be blotted even by the tear of the recording angel ; here you have come together from North, South, East, and West, as one brotherhood to show by your words and deeds how Peace hath its victories no less renowned than war ; and how we can by the diviner instincts of our nature, make our republic one, and what she ought to be, the "mother of a mighty race."

Gentlemen of the American Public Health Association, we bid you all-hail ! and welcome to the hospitalities of Richmond.

II.

ADDRESS.

By JAMES L. CABELL, M. D.,
First Vice-President.

Gentlemen of the American Public Health Association; Ladies and Gentlemen, — The pleasant duty has been assigned me, as a citizen of Virginia, to introduce to a Virginia audience the distinguished presiding officer of the American Public Health Association, — Dr. Elisha Harris, of New York, whose annual address is announced in the programme as the leading feature of the evening's exercises. To those who have heretofore become members of the Association and by whose suffrages Dr. Harris has been selected to fill this post of honor, it would of course be unnecessary to recite his claims to their respectful attention. To others I may be permitted to say that his life-long and zealous devotion to sanitary studies, and his unwearied and disinterested labors for the improvement of the public health, not only in his own section, but throughout the length and breadth of our common country, have won for him golden opinions from the votaries of sanitary science all the world over. It was once publicly said of him by a most competent judge, that "he is our leading sanitary authority" in all that relates to the vital statistics of our country, and the deductions to be drawn therefrom, and that, "to him, with Dr. Stephen Smith, of New York, a former president of this body," the country owes a measureless debt of gratitude." Here I might stop, but he has especially requested me to give expression to the earnest wish felt by himself and the leading advocates of sanitary reform, that those who have been attracted for the first time to the meeting of the Association by the special interest awakened by the recent epidemic, will not allow that feeling to die out with this special occasion. They have nearly the same motives for interesting themselves in efforts to stamp out those numerous preventable diseases which in the long run count many more victims than yellow fever ever destroys, though by reason of our familiarity with their incessant ravages we accustom ourselves to look upon them with equanimity and comparative indifference. It is the special province of the medical profession to search out, and, when found, to publish to all the world, the causes of disease; and here its special function in regard to the preservation of the public health properly ceases. The members of that profession have a less direct interest and far less opportunity than the other educated classes of the community for bringing about an efficient application of the means necessary to avert the causes of disease which their scientific investigations may have disclosed. Even in England, with her admirable system of sanitary administration, which has been characterized as splendidly comprehensive, and the practical working of which has produced a marvelous diminution of the mortality of the kingdom,—it has been asserted by the late medical officer of the Privy Council "that at least one hundred and twenty-five thousand of the five hundred thousand deaths which annually occur, in that country," could be prevented if existing knowledge of the chief causes of disease were effectually applied." When we consider that these one hundred and twenty-five thousand preventable deaths represent nearly four millions of cases of disabling and preventable sickness, we may form some idea of the enormous pecuniary loss, to say nothing of the untold amount of needless human suffering and misery realized in those states which, like our own, persistently refuse to make any outlay for the preservation of public health. There is therefore a pressing *desideratum* to convince law-making authorities of their duty in the premises. To this end we need the combined counsels of lawyers and statesmen to consider delicate and difficult questions which involve the rights of individuals and of States, and the constitutional limitations of State and Federal authority. We need the aid of all educated classes to diffuse among the people a knowledge of the enormous expensiveness of disease and of the wise economy of a judicious outlay for its prevention. We ask your coöperation in this beneficent work. I will not further trespass on your time. I now bespeak your earnest attention to the words of wisdom which will be addressed to you by the presiding officer.

III.

SIGNIFICANCE OF THE RECENT EPIDEMIC. — DUTIES OF THE AMERICAN PUBLIC HEALTH ASSOCIATION.

AN INTRODUCTORY ADDRESS AT THE ANNUAL MEETING IN RICHMOND, NOVEMBER 19, 1878.

By ELISHA HARRIS, A. M., M. D., of New York,
President of the Association.

This Association accepts the welcome of Virginia, and in this beautiful City of Refuge is now to respond to these eloquent and cordial greetings of the noble Governor and the learned master of medical science and hygiene, who have here opened the sixth annual meeting of this body. In the name of all who have assembled at this sanitary council and of the hundreds who are detained by duties in the communities smitten with a pestilence, I cordially reciprocate the sentiments with which the Governor has greeted, and Professor Cabell, as president of the Board of Health of Virginia, encouraged us at the opening of this session.

Richmond, the City of Refuge, that never has closed its hospitable doors against those who flee from cities and towns invaded by yellow fever, thus warmly greets this national council of health that, if possible, the hygienic laws which shall give security against this infectious destroyer may here be discovered and enunciated. From the seven or eight States that are now suffering from the scourge, and from all the other States, have assembled here the active workers in the fields of public hygiene, who will contribute whatever they can to the solution of the problems of sanitation which our country now calls upon this Association to define and solve.

The deplorable epidemic of yellow fever that has desolated the population of the great valley during the past summer and autumn, has filled our minds with awe, while it has brought wailing and terror into the homes of nearly one hundred cities and hamlets of the river States. Now, in the very last days of its prevalence for the present year, this terrible pestilence leaves to the public health authorities throughout the United States, and especially to this Association, the duty of studying its history, of penetrating the mysteries and realities of its causes, and of reaching practical conclusions concerning the ways and means by which such causes shall be overcome and the ravages of this destroyer be henceforth and forever prevented within the boundaries of our country.

After thirty years of observation and study, and at various seasons in the responsible official care of yellow fever patients, and after careful study into the facts and reasonings into the causation of this disease, it does not become me to speak dogmatically concerning this most separate and peculiar of the infectious and destructive pestilences. Nosological distinctions, ætiological theories, and the ever-varying phenomena of meteorological conditions and other circumstances of the hot seasons and local conditions which mark the history of successive epidemics of yellow fever, do not affect the one most essential fact, that this is not a pandemic pestilence, but is a malady whose geographical range is more remarkably and sharply limited than that of any other infectious pest. All experience from its prevalence hitherto proves that the domain over which its ravages have extended is so well defined and so limited as to warrant the belief that by united counsels of the public health service of the civilized world it may soon be found practicable to define the essential facts concerning the factors of causation that enter into the propagation of this strange and destructive pestilence within the geographical limits that are recognized as the boundaries of the "yellow fever zone." We say this with much confidence, and with an ardent desire, for it is in the interests of civilization and humanity that this triumph of sanitary knowledge should be achieved. It has been predicted, indeed, by the best minds in the medical profession; it is a result to be expected as an outcome of definite and well-directed scientific researches. It is necessary for the welfare of society, for this disease, more than any other known among the peoples of the earth, strikes with terror every community in which it appears; it obstructs and temporarily destroys the transactions of the commercial world far beyond the limits of its immediate prevalence; desolates the habitations of the wealthy and the poor alike, while medical skill is baffled and impotent in its presence. What scenes have Memphis, Vicksburg, and New Orleans witnessed in the unequal conflict of medical skill and this dire pestilence the past four months! Thus it has been with every successive visitation of yellow fever epidemics, and, in the midst of each one, it has been as true as in that which Sir William Lyon described in Lisbon when last that city was visited by yellow fever: "Disease, in one of its most appalling forms, held sway, and Art stood helpless by." Confessing, as every competent and conscientious observer and practitioner of medicine does confess, this inability of curative medicine in the management of yellow fever epidemics, how gladly does every right-minded person turn and invoke all the resources of hygiene, all the duties of social and domestic life, all the means and all the concessions and aid that commerce can give, and all that law and judicial science can offer, to enable the public health service of the cities, states, and nations which are concerned, to prevent the spread, and, if possible, to extinguish the causes of this disease.

We have said that the recognized geographical limitations of the existing yellow fever zone warrant an undertaking in the interests of the civilized world, and by all resources it can offer, to gain the mastery of this destroyer. We offer no theory, we utter no dogma, we expect no miracle, but we do ask and believe that scientific investigation can and must secure this important result. We pause here for a moment to say, because we know, that the investigation which is now in progress by the Commission under the direction of the Surgeon-general of the Marine Hospital Service, was conceived, advised, and is conducted strictly in accordance with this firm and fervent purpose, to know, record, and fully report the course and causes of this deadly epidemic, which has so greatly overleaped all its former limits.

Members and officers of the American Public Health Association became responsibly concerned in the organization and plan of this important investigation to the extent of their right and ability to do so. Our nation, and *all* civilized nations, will indorse the verdict of physicians, philosophers, and statesmen that this was a duty, and that it will continue to be a duty to press forward these researches to definite conclusions, and to couple with them also all the best experience of the past in devising the public measures and perfecting the sanitary service that shall henceforth stay the progress of the pestilential infection, and, as soon as practicable, give such efficiency and comprehensive means of certainty to the public health service in the entire domain of our nation and of all countries with which it is internationally allied, that the pathways of commerce shall be unvexed by this infectious pest, and by the crude and ineffective methods of quarantine and police interference over which ignorance and caprice preside. This National Public Health Association convenes to-day in the capital city of the Mother of States to examine, sift, and analyze the body of evidence which we have begun to accumulate, and concerning which, and the duties that lie beyond this anxious beginning of our effort to know the worst and to know the whole of the truth, all the States and municipal authorities of the regions visited, or liable to be visited by yellow fever, are, by their working representatives, now cordially gathered with us in council upon these momentous questions.

It matters not to any of us, even if battered with the conflict of decades of repeated campaigns of war against destructive diseases, if it should chance to be proved that any previous opinion, theory, or practice concerning the infective factor or the localizing causes, or the means of stamping out this subtle pestilence, were disproved or superseded by more definite and practical verdicts of such a grand court of hygiene as this. It matters not to any of us personally, if it should be shown that yellow fever seemed to be personally contagious in the old French quarter of New Orleans, or along the slopes of the Bayou Gayoso, or, — as certainly might appear to be true, — upon the fine new steamboat *John D. Porter* and its trail of fifteen or more intensely infected barges, or in the Walker family and others which received their death from these *floating carriers* of the pestilence, on the farms two miles below Galliopolis. It matters not if in Grenada, or Vicksburg, or Cairo, or at Pascagoula, or Mississippi City, or even at Chattanooga, a mountain city of the midland States, it were claimed that the yellow fever the past season was of domestic origin, if ever it shall be so demonstrated. We venture to believe that every gentleman worthy of membership in this Association, or of recognized standing among scientific hygienists, has come to this National Sanitary Conference fully prepared to examine all things, and hold fast to that which is true. We invoke for all the deliberations in this week of conference a scrupulous adherence to this first duty; for this we owe to society and to science.

In the anguish of terrible scenes of the pestilence at New Orleans, Vicksburg, Grenada, and Memphis, and in nearly a hundred of smaller cities and towns in seven or eight of the States which were invaded by yellow fever this year, it was not surprising that the people cried out to God for mercy, and that they fasted and prayed in the hope that the unseen Ruler of the world's affairs might save. It is equally natural now that there should be thanksgiving and rejoicing as the scourge is withdrawn. The sympathy of the good and the gifts of the affluent have been poured out without stint, — all this was fit to be done. The golden bonds of friendship, the brotherhood and enduring fraternity of the States of the Union, even the warm sympathy of Europe, thus have been evinced and beautifully illustrated! But it is the mission of hygiene and of preventive medicine, — it is the privilege of *Science*, — while recognizing the gentle and loving expressions of the saved and safe to the suffering and dying, now to gather up all the resources of knowledge and research, and to command whatever means hygiene, public health laws, and sanitary measures can offer. This Association now begins its part of the great duty, and it may be found necessary to spend the entire time of the next two or three days in an examination and discussion of the body of evidence which has begun to be accumulated. Next will come other parts of this undertaking which will compel us to appeal in no uncertain tone to the legislative and executive authorities of the individual States from Louisiana and Texas, Mississippi, Alabama, Florida, Georgia, and the Carolinas to even the remotest of the commonwealths that can be invaded by yellow fever, cholera, or any other pestilence portable by water or land, to prepare and agree to do those things necessary for the control and extermination of these enemies of life and health. State Boards of Health, which are now actively in operation in sixteen of the commonwealths, must be recognized as being essentially necessary for the success of any practical plan for such general sanitary protection. The Association will undoubtedly give some adequate expression to its view of the necessity of well-organized sanitary service in each State. It is equally important that after due deliberation, there should be a well considered and manly expression by this Association with regard to both the comprehensiveness and unity of such public health service throughout the Union. Whatever ground is taken with reference to this subject, it will almost necessarily comprehend that which pertains to the domain of a national sanitary service, which now, after the blood of two millions of men has so cemented our nationality that the southern and northern States alike may be willing, for the common welfare of all, — and not for them and this single nation solely, but for the *Nations*, — to do whatever needs to be done to guard life and health throughout all the pathways of this continent through which people of all the civilized world are passing to and fro, and to which their ships come, and whence their ships and ours go forth to every land. Fortunately, the Association will tread upon no uncertain ground when it notices, first, the duty of the States individually as well as of municipalities; for several eminent jurists and legislators, never guilty of unguarded utterances, offer their cordial approval of the effort of this Association to proceed from this conclusion concerning

State and municipal obligations, to those affecting the nation's duty to aid, harmonize, and, when necessary, lead in the work of public health care.

All experience shows that it is both wise and safe to encourage the accumulation of the largest amount of facts and well-digested evidence, and the studious analysis and discussion which should follow such gleaning. To the analysis and the discussion, and all that is now in store for this Sanitary Conference, the gentlemen now assembled from all parts of the Union are invited.

We turn now to the duty and business of the conference. We lay aside, as far as we may, all care of what comes of the differences of personal opinions and the diversity of interpretations of facts and events in the history of disease and of the recent epidemic. On our right hand and on our left sit the faithful officers of the sanitary service in the great cities and ports of this continent. From the ceaseless care and vigilance which for months they have endured in the single purpose and with all the skillful aids they could command for saving life and guarding the health of the cities and States in which they toil, they come up to this conference to contribute whatever they can to the science and the art of public hygiene. In the name of this Association we bid all these co-workers welcome. Savers of men, truest friends of the best interests of the cities, the States, and the nation which in this protracted conference they most honorably represent, they need no other introduction to this assembly, or to the people of this beautiful city, than that which the roster of the working ranks of this conference will show from day to day.

In conclusion, let not the fact be overlooked that it is not merely to rescue to-day the people who are liable to be cut off by fevers and pestilences, that it is not for the protection and increase of the commercial and public unity for a single year or a single generation of men, that these duties of the American Public Health Association and of the physicians and hygienists of our country are undertaken; there is a more permanent result, a more comprehensive influence exerted upon the destinies of our fellow-men and of the nation at large ever to be kept in mind, — this is the inspiring view which all cultivators of sanitary knowledge and workers for the welfare of society take. The sweeping pestilences and other destructive diseases indicate the various deep-seated wrongs and neglects, vices and sins of the people, and even when the most virtuous and those who are without blame and fault are smitten with these diseases the human race itself — in its individuals, families, and communities — suffers. "Wherever," says Dr. Farr, "the human race is in such a situation as to lose its strength, courage, liberty, and wisdom, the plague, cholera, or fever comes, not committing havoc perpetually, but turning men to destruction, and then suddenly ceasing. As the lost father speaks to his family, and a slight epidemic to a city, so the pestilence speaks to nations, in order that greater calamities than the untimely death of the population may be avoided."

While this is the sixth annual meeting of the Association, and the ninth conference of the friends who organized this body, the plan of effort and duty, as matured from year to year, — by members constantly increasing in numbers, — though not yet changed in any respect, should, we think, be made to enlarge its verge and scope, in all respects in which public health interests and the progress of sanitary knowledge may warrant any modifications and enlargements of the functions and methods of the Association. When, on the thirteenth of September, 1872, the plan and methods of the Association were adopted, and its duties begun, eight States of the Union were represented in the unanimous vote for the adoption of the same. At that time only three or four States had provided for State Boards of Health, and not one in ten of all the cities in the United States then had efficient sanitary service, or any thing like a rational code of health laws.

To-day, the beginning of the seventh year of the Association's life, we look out from the capital city of the State of Virginia upon nearly fifty cities that have organized reasonably sound methods of sanitary government, and which have drawn into the public health service the resources of sanitary science, the skill of preventive medicine, and the arts of sanitary engineering and chemistry. More than this, sixteen of the States now have organized State Boards of Health; and, without exception, the memberships of all these sixteen boards are worthy the privileges and duties of membership in the American Public Health Association. Indeed, the majority of these State commissioners of public health already are members, and before the conference at Richmond closes, all of them no doubt will stand in these ranks.

This is not all that has occurred in the progress of sanitary government and public health care in our States and cities in the past eight years to help this Association to move on in its plan and methods. The people have become awakened to the importance and the obligations of the care for the public health, as well as for their domestic and personal hygiene. This Association has had its share in the good influences and the public efforts that have thus incited the interest and concern of the people in these matters. Some of the municipal sanitary boards have had a large share in the same good work, and it is an obvious fact that, in every State that has organized a central board of health for its own Commonwealth, the people have become at once more and more interested and active in the duties which promote public health, as well as in those that immediately concern their personal and domestic hygiene.

It is obviously our duty now to re-survey the field in which this Association has labored these past six years, and with the same unselfish, conscientious consultation and deliberate effort that founded its existence and have maintained its work, reëxamine its foundations; to invite to its councils the responsible support of all those noble men who have founded the State Boards of Health, and wisely laid the corner-stone of the temple of Hygeia in sixteen great commonwealths; likewise to consult with all the true and competent officers of health in the chief cities and large towns of our country. The ablest statesmen, the purest and best of our legislators, State and national, true naturalists and great physiologists, and teachers in medical and allied sciences, the leaders of education in our great universities, and numerous able jurists, to-day offer their contributions and lend their aid in the solution and practical exposition of public health problems.

With such alliances, and arrayed as an organized force for the practical works of hygiene, the American Public Health Association — if the speaker may be allowed to use its name and utter its voice — accepts a fraternity so excellent and noble, and it will, it is believed, not only offer the right hand of fellowship, but invite these actual associates in the public health service to take part in the needed counsels for the enlargement and strengthening of all parts of the plan and service for which this body exists.

The existing departments of public sanitary and medical service of the nation, — the army and navy and the marine hospital service, — have done their full share in the maintenance of this central organization for the promotion of public hygiene. These three branches of service will continue their fraternal and distinguished labors. The medical profession now, without exception, heartily encourages and sustains this Association. The best engineers and contributors to the arts and sciences upon which the great works for promoting public health must depend, are already the supporters of the Association. The ablest statesmen are the judicial and friendly advisers of its officers, and have offered to accept seats in its councils. This we announce with peculiar satisfaction, though it has been true from the beginning that such men have steadily given aid and encouragement to the officers of the Association.

It is not for me to magnify the mission of the Association, much less would I willingly disturb its policy, except in the direction of greater usefulness and more comprehensive resources. In this view, let me urge that the Association shall, during the present session, undertake to make its basis and structure throughout sufficiently complete to bring into closer apposition in its counsels still larger resources, both in membership and in methods and actual undertakings. Working with you and for you these many years, and even in labors and organizations antedating the existence of this Association, it may be permitted me to say, though I assure you I speak it humbly and gratefully to you, that all experience and the principles we most revere in moral, social, and public duties, require of all good workers the largest degree of fraternity and coöperation in plans for improving and protecting the health and welfare of our fellow-beings. Science and the arts, experience, experiment, and study, are to be invoked in such work as ours, and we must continually extend the invitation of such an Association as this to those who can make the best contributions to sanitary science and practice. I deem it a duty to suggest, among other modifications which may be found practicable in the organization and work of this Association, the following: —

1. That each State Board of Health shall be entitled to one seat in the Executive Committee of the Association, that member being elected by his associates in such board, and to hold office for the term of one year.

2. That members of the State Boards of Health be *ex-officio* members of the Association.

3. That the elected members of the Executive Committee, as now pro-

vided for in the constitution, in respect of election by the Association itself, should year by year be equal to the total number of members *ex-officiis.* This committee to be henceforth designated the Council of the American Public Health Association.

4. That for the purpose of encouraging, and definitely shaping the special expert kinds of investigation and the scientific reporting of the same, and for encouraging continual researches, and scientific experiment, there should be such an arrangement of members who can so contribute, that they may work in appropriate committees or *Sections*, as designed in the original construction of the standing committees, — which now requires essential reconstruction, both as to the committees and the scheme of action.

5. The maintenance in each State and Territory of a system of periodical reports, weekly, monthly, yearly, of all epidemic and other prevalent diseases which the State Board of Health, in States where there is such a board, shall supervise and provide for, and in States and Territories where there are no such boards, this duty to be performed by resident members of this Association, designated for the purpose. All such methods of study and reporting being organized in such manner as to yield entirely comparable and harmonious results.

6. The study of meteorological phenomena and atmospheric conditions strictly with reference to practical results in regard to epidemiology and health.

7. The maintenance of a committee or section of members for study of and consultation in regard to, practical objects in biological and anthropological investigations, inclusive of whatever contributions to this department may be secured through the census and other national and State systems of registration and records.

8. The introduction of a clause into the constitution of the Association to provide for the steady encouragement and counsel, if not for actual editorial and supervisory duty in the publication and diffusion of sanitary information and popular instruction upon the most essential and most neglected duties which affect public health.

9. It is earnestly recommended that there should be a formal recognition of both national and international obligations and opportunities in the work and purposes of this Association. Such recognition by the Association in its communications with the State, national, and international authorities, — civil and sanitary, — should be undertaken as the duty which this Association owes in its public relations. This section or branch of the Association's work should be so organized and managed as directly to conduce to very important practical researches that are already in progress in Europe, and to some extent in our own country, in regard to pestilential diseases, and their contagia, and all other general and specific improvements in public hygiene. But, aside from this, the national and international facilities and mutual opportunities with reference to the progress and applications of sanitary knowledge and the protection of the public health in all civilized countries, warrant the preparation of a practical working plan, for this branch of duty, by the American Public Health Association.

These bare outlines of specific general propositions, may serve to show what the filling up and rounding out of the body, muscles, and sinews, and vital forces of the Association, should, if possible, become. The details that must enter into each of these separate propositions can readily be arranged, indeed, they already are, in some good degree, in the minds of members of the Association, and will be affirmed by the good judgment, and perfected by the sincere and fraternal criticism of members now in attendance at this conference.

IV.

A BRIEF REVIEW OF THE ORGANIZATION AND PURPOSE OF THE YELLOW FEVER COMMISSION.

By J. M. WOODWORTH, M. D.,
Surgeon-general of the U. S. Marine Hospital Service.

At this hour of the evening I can only make some introductory statements in relation to the business which has brought us together, and I shall therefore detain you with but few words. I need not recount how the invisible seeds of death which found lodgment in New Orleans multiplied and were carried on the wings of commerce and traveled along our inland highways until four score cities and villages of the valley of the Mississippi were turned into mourning and a hundred thousand of the people were stricken in their homes and twenty thousand lives were sacrificed on the altar of a preventable disease. The sad history is familiar to you all. But it would be strange, indeed, if in the midst of this appalling calamity the public mind were satisfied with bare knowledge of its progress and would inquire no further than as it appealed to the beneficent sympathy which flowed from all sections of our country. The spirit of deeper inquiry, characteristic of the present day, did not quietly slumber while disease and death were working out their terrible tragedy. Early in the epidemic the thought of the people turned to questions of its cause and measures for its prevention. Petitions and individual appeals were made to the President, calling upon him for the appointment of a commission to investigate the epidemic with reference to safety of the public health. Unfortunately our government does not provide a contingent fund to meet emergencies such as this; but fortunately there is a compensating public spirit among our people, and in this emergency, as is often the case, it gave utterance from the heart of a woman. Upon the assurances of this public-spirited woman,[1] and with the approval and advice of leading members of the American Public Health Association, and of public-spirited commercial men of the city of New York, who with others have since contributed of their means, the Yellow Fever Commission was organized on the first of October and the work of investigation was commenced while yet the great tragedy of the exotic enemy was being enacted. This Association has convened to determine, as far as possible, the causes of the commencement and spread of the epidemic. And while you may regard the responsibility of this determination exceedingly great, I congratulate the whole country that it has fallen

[1] Mrs. Elizabeth Thompson. — Ed.

to the lot of gentlemen so eminently wise and discriminating as are here in council. The evidence which the gentlemen of the Yellow Fever Commission have gathered is to be sifted by you, and the important facts singled out, tested, and established as the foundation upon which the theory and practice of preventive measures may securely rest. The Commission will bring facts only—facts gathered by patient, careful inquiry, made from city to city and from house to house. The work is not yet completed; and it will not be abandoned until all the facts possible to be obtained are gathered, either by the present Commission or another, or an enlarged Commission, as this Association may advise or Congress direct. The same spirit which has sustained the inquiry so far will provide the way to complete the work. From this place, where the truth already gathered shall be presented and views exchanged, and the threads of evidence gathered up, and conclusions drawn, the Commission will return to their work with fresh enthusiasm, carrying with them, as they richly deserve, the encouragement of your Association and the thanks of the people and the benedictions of humanity.

V.

AN ADDRESS ON THE OBJECTS OF THE ASSOCIATION, AND ITS CLAIMS UPON THE PEOPLE FOR SYMPATHY AND SUPPORT.

By Hon. LEWIS H. STEINER, A. M., M. D.,
Of Frederick City, Md.

This Association has chosen as the special objects of its labor, "the advancement of sanitary science, and the promotion of organizations and measures for the practical application of public hygiene." The duties thus assumed are theoretical, in so far as they require the investigation of the laws of health and disease; but also intensely practical, since they aim at the elimination of every natural cause of preventable disease. While the inspiration that brought it into existence came from that profession whose mission it has been from its own inception to alleviate human suffering and to mitigate the fell power of disease, still it has invited to membership all persons who look upon human life as too precious to be sacrificed at the shrine of ignorance, or in consequence of a willful disregard of hygienic laws. Animated by a common desire to advance the public health to the highest possible standard, its members are drawn from the ranks of every profession and occupation, and no shibboleth is demanded on admission save that which will enable them to appreciate and appropriate the sentiments contained in the celebrated line of Terence: "Homo sum: humani nil a me alienum puto;" I am a man, and deem nothing that concerns the good of humanity beneath my earnest consideration. In our crusade against the causes of preventable disease, we might adopt the words that Charles Kingsley puts in the mouth of Tom. Thurnall, one of his heroes, as the brief embodiment of our views: —

"I hate disease. I hate it, little or big. I hate to see a fellow sick. I hate to see a child rickety and pale. I hate to see a speck of dirt in the street. . . . . I hate neglect, incapacity, idleness, ignorance, and all the disease and misery which spring out of that. There 's my devil; and I can't help, for the life of me, going right at his throat, wheresoever I meet him."

With a creed full of positive love for the race, and profound respect for "the sacredness of human life, the value of health, the claims of humanity, and the requirements of the beneficent laws of nature," and full of intense antipathy to everything that would antagonize these and make them of little value, the American Public Health Association has striven earnestly, year after year, to do its full work towards the solution of the problem it has chosen for itself. In this work it has been trammeled by no restrictions imposed by politico-geographical bounds, save those that mark the limits of the country to which its members belong. It has known no north, no south, no east, no west. It has restricted its energies to no particular class, whether high or low, rich or poor, educated or ignorant. It has confined its investigations to no particular race, whether Caucasian, African, Mongolian, or Indian, but has been eminently catholic in striving to bring the aid of sanitary science to every human being, living, breathing, and suffering, within the boundaries of our common country. With political parties it has no affiliation, and with denominational restrictions and exclusiveness it has no sympathy. Casting aside all such comparatively insignificant causes of dissension and division, it strives to occupy a broader plane upon which it can pursue its work under the grand motto, —

"Orandum est ut sit mens sana *in corpore sano.*"

The present is a favorable time for the prosecution of the objects of the Association. War no longer commands the attention and consumes the energies of the nation. During its protracted stay it inflicted a weighty load of physical and mental anguish and suffering, and we trust that it has taken leave of us never more to return. To regain prosperity we must once more restore fraternal affection to the hearts whence it was driven by deadly hate, and be united under the flag of a common country, in all that will redound to the physical, mental, and spiritual advantage of its citizens.

Holding our annual meeting this year for the first time in a southern city, it is fitting that the chief subject assigned for our papers and reports should be that terrible scourge which has laid so heavy a hand upon thousands of the citizens of the South during the past season, and whose deadly power has not yet been wholly checked, but which, while its disastrous effects have fallen so mightily upon one portion of the nation, has awakened a love and intense sympathy throughout the whole, that have struggled to find the most fitting modes to effectively manifest their existence. Not only have contributions of money, food, and clothing been forwarded with unprecedented liberality, but some, instigated by the grandest form of philanthropy, in their longing to carry succor and relief to those suffering from the pestilence, even took their own lives in their hands, and, while striving to aid their suffering brethren, passed from earth to their final reward. The history of the pestilence has been made irradiant with grand examples of self-sacrificing fraternity, fit to be enrolled along with the most brilliant ever known to mankind. And thus the terrible clouds of yellow fever have had a resplendent silver lining, reflecting the glories of that heaven whence the inspiration was drawn that animated such generous, noble-hearted self-sacrifice. The fever did not expend itself in the sufferings it caused in the South, but created, so to speak, a community of suffering throughout the whole country. The nation bewails the loss of her children, and her heart bleeds over the anguish and desolation that have been brought to many a domestic circle. Shall not her sons, thus bound together by common afflictions, be drawn together more closely by a oneness of feeling that will tolerate no antagonisms henceforth, except such as may arise from earnest efforts to maintain her good name, and to add to her honor and glory?

We more than suspect, we almost know, that most of the lives lost in the recent epidemic, and most of the treasure expended, might have been saved to the country had due regard been had by local authorities to sanitary laws. We know that hundreds of thousands pass, year after year, into the shadow land in consequence of the mortal effects of preventable disease; that a low grade of health exists in our cities, proceeding from bad drainage, defective ventilation, and the use of impure drinking water; that our villages and small communities are exposed to repeated visitations from typhoid and other low forms of disease in consequence of gross neglect of sanitary provisions; that our public buildings are constructed with no reference to the health of their inmates; and that there is, all over the land, gross, unpardonable waste of human health and human life.

To study these, and kindred forms of waste, requires the aid of sanitary experts; but to secure the necessary remedies there is demanded the assistance of every citizen of the land. Wherever there may exist that which endangers public health, it should be eradicated by the might of proper authority; and yet this cannot be secured or sustained unless public opinion has been educated up to a full understanding of the subject. Hence it is necessary to enlist the people in our efforts, and by their aid to accomplish the vast work, the outlines of which we are only able to indicate. When they shall be fully aroused to the importance of the subject, they will allow no man to contribute, by his own ignorance or carelessness, to the filth-diseases of a community, and no community to accumulate the food upon which yellow fever and kindred affections may feed and grow to gigantic proportions. When the people shall have been educated in regard to hygienic requirements, they will be ever ready to hail that sanitarian with honors whose labors have protected a community from preventable disease, and to adorn his brow with the civic chaplet of oak leaves with the same enthusiasm that the Romans manifested in honoring the soldier who had saved a comrade's life in the perils of battle, and then public sentiment will indorse and aid in the enforcement of every law enacted to insure the observance of regulations necessary for the preservation of the public health. That that day may speedily arrive is the heart-felt wish and prayer of every student of sanitary science.

Enlisted in the pursuit of the objects already mentioned, and recognizing fully the need of intelligent, popular support of its conclusions so that they may be made effective hereafter in the form of legal enactments, the Association is anxious to obtain the good will, the honest sympathy, the hearty coöperation, and the fervent prayers of the people. Our objects must commend themselves to every thoughtful mind; but we wish to do more. We aim at exciting that promptness of action with reference to the removal of local causes of disease which may insure its non-appearance. When the pestilence breaks out, every one is willing to aid in the instituting of sanitary regulations, and in the enforcing of them with the greatest strictness; but then the mischief has been done. The true preparation is to be made by erecting barriers, over which the disease cannot come. We wish to prevent its appearance, and we can only do this by making the people alive to those hygienic rights which are essential to the possession of normal health. Every human being has an inalienable right to pure air for the proper oxygenation of his blood. Where the air is tainted by any foreign substance detrimental to health, be the quantity large or small, so great as to be readily recognized by the organ of smell or so infinitesimally small as to be utterly inappreciable by it, injury is done to the individual. In like manner is he entitled to water free from organic contamination, — free from that which will beget disease in the human economy. Where this right is denied him through the contamination of his natural beverage, whether by the ignorance or willfulness of his fellow men or by other causes that can be removed by human ingenuity and authority, injury is done which will manifest itself in some way or other, and affect his usefulness to himself, his family, and his life-work. And, again, man is entitled to all the blessings dependent upon *material* cleanliness, as regards his surroundings. Where he is robbed of this, whether through filthy personal habits or the indifference of legal authority, he is made to suffer a wrong that not only brings detriment to his physical well-being, but also to his mental activity and his spiritual purity.

These hygienic rights we wish the people to insist upon as indispensable to the highest development of their manhood, and to be constantly on the alert to oppose every agency that will interfere with their full enjoyment. Give the human being pure air, pure water, and absolute cleanliness of surroundings, and you place him in the best possible hygienic situation for the development of high health.

The principal subject of discussion during this meeting will be the history of an epidemic, dependent for its terrible virulence upon the violation of these hygienic rights, which has cost thousands of noble lives and millions of treasure. We believe such a terrible experience need never again be repeated, and, in the name of humanity, we appeal to the people to bestir themselves in the adoption of measures that will not only protect them from another such invasion, but will tend to drive preventable disease from our land.

VI.

HOW TO STUDY AN EPIDEMIC.

A DISCOURSE BEFORE THE ASSOCIATION, AT RICHMOND, NOVEMBER 21, 1878.

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THE study of an epidemic is important not only in reference to the special disease it concerns but in its bearing on the whole extent of medical art. It affords a nucleus which invites to definiteness of aim and discernment in execution, at the same time that it enables us to present a contrast to that lack of precision which some diseases encourage by the temptation they present for us to deal with generalities.

An exact method of study in an epidemic presents a model on which can be constructed the best plan for all medical investigation, and so tends to aid us in all departments of our science.

How to study anything aright is among the chief attainments and the royal road to acquirement from which most of us have too many unperceived deviations.

On some accounts methods of study are less determinate and more perplexing in medicine than in other pursuits. We cannot, as in mathematics, arrive at conclusions by methods which are thoroughly precise. We cannot, as in metaphysics, get clear of much of the merely phenomenal, but have to deal with all the details and apparent contradictions of nature. Logical analysis of the materials which heap themselves about us is far more difficult than when we only have to deal with the philosophy of mind. We can readily reason from particular facts to general truths when our facts are those of consciousness or well established history. But it is much more difficult when our particular facts are to be derived from the observation of imperfect men, and when these are to form the premises on which all our reasonings and conclusions are to rest.

The historical and clinical methods of study are so important and are sometimes so dwelt upon as to incline us to discursive rather than logical methods of considering facts. We are more embarrassed than in ordinary physics and those allied sciences in which the machinery is less variable than is the body on which our experiments are tried. The tests of the Scientific Institute may be elaborate, but sources of error and character of result are more directly under the eye, while in chemical analysis the chemistry of the retort is a far more verifiable thing than is the chemistry of the living being.

A reliable experience in our department can only be the result of an assemblage of experiments tested under the most severe exclusion of all sources of error, assorted and compared under the most rigid scrutiny, and adopted as conclusions only after having been, without prejudice, tested and compared with the experience of observers who may reasonably be supposed to be equally competent, or who furnish us in detail with their methods. We are so constituted that in the very acquirement of our facts we are apt to come to a prejudgment as to their meaning before we have given due weight to the facts which have been conscientiously observed by others and which they perhaps are persuaded tend in an opposite direction.

It is this condition of things that led Cullen to say, "There are more false facts than false theories." Says an eminent authority in law: "Statements are often false in fact when not willfully so, from errors of the senses, of the imagination, of the memory, or of the mind more frequently than *they* might suppose whose occupation it has not been to sift and weigh the worth of evidence."[1]

How erring the senses are, and how much their impressions may be moulded by the mind; how very fallible is information seemingly the most assured, it needs no extensive observation to teach.

So strong is this unconscious bias that the remark of Sir Gilbert Blane on the competency of the three commissioners appointed by the French government in 1805 to investigate the two more recent Andalusian epidemics of yellow fever is quite defensible. "It has been objected," says he, "by the other party, that those commissioners were not on the spot when the epidemic prevailed. If this objection were well founded, it would go to invalidate all judicial investigations whatever. It is not deemed a necessary qualification for a judge on the bench that he should have been actually present at the transaction upon which he is to decide. On the contrary, by an accurate and comprehensive survey of the points and bearings of a complex case, he is better qualified to form an opinion than the actual actors in them, besides being divested of prejudice. It is requisite, for the forming of a clear, calm, and impartial judgment, that objects, whether natural or moral, should be placed at a certain distance, in order that they may be seen in those relative positions and bearings which the eye and mind of a close observer, or of a party concerned, is incapable of taking in. A soldier in the midst of a battle, knows much less about the main incidents and results than a shepherd on the neighboring hill. And with regard to the distance of time, the investigations not having been made till 1805, four years after the epidemic of 1800, and one year after that of 1804, the same principle will apply to it as to general history, in which it is a maxim, universally admitted, that no impartial history can be written till a whole generation at least have passed away. The same length of time may not be necessary to mature medical as historical truth; but after a still longer interval than what is here objected to, it is presumable that the question will be viewed in a still clearer light."

"In this great work, we need," says one, "an appropriate natural capacity, the good fortune of not being beset with prejudices in early life, an habitual exercise in the observation of nature, a candid and ingenuous disposition, an

[1] Reed's *Practical Sug. on Evidence*, p. 292.

ardent love of truth, an exalted sense of duty, a large store of facts in a correct and tenacious memory, and the power of combining, comparing, and discriminating these, by an intuitive glance in the moment of applying them, to the practical end in view."

With such demands for special and symmetrical capacity for the study of epidemics, it behooves us first of all to decide upon methods of procedure, to guard against avoidable complications, and to have clear conceptions of the best way for reaching truthful conclusions. As we are thus met for conference it may be pardonable in me to suggest what may seem the essentials for success.

1. The first requisite is a thorough understanding of the sense in which our technical words are used. We can investigate no subject intelligently until we understand ourselves in the use of terms. We cannot confer with others until they too understand our terms and accept them in the sense in which we use them. Now to us nothing is so confusing as the ambiguity which at present exists in this regard. We do not just now refer to such as arise from difference of diagnostic view, in respect to various fevers or infections described under one name, although Blane in his "Medical Logic" cites yellow fever as difficult of discussion because of this ambiguity, and Fenner's Reports, so late as 1850, refer to the confusing want of definiteness as to diagnostic marks of yellow fever. We here refer to such terms as have to do with epidemiology. Within the last two years we have been at some pains to study this class of words with reference to their origin, their philosophy, and their classic and popular use, and the variable senses in which they are employed by different authors and sometimes by the same author.

How often do we hear it said that a disease is infectious but not contagious.[1] Yet Bacon, Worcester, Dunglison, make infection and contagion quite synonymous. The lexicons all admit their promiscuous use, and most physicians, while defining them as different in form, use them somewhere and sometimes as the same in fact.

Parkes, Wilson, and Cameron, are not agreed in their distinctions, and Alfred Carpenter, in his recent elaborate address before one of the sanitary associations of England, says: "In defining my subject I have used the terms infectious and contagious as if they referred to different classes of disease; this is not so, the terms are convertible. It used," continues he, "to be supposed that infectious diseases were conveyed by various channels, such as the air, whilst contagious diseases only arose from contact with other cases. This rule is not found to apply, and all this class of diseases are more or less infectious as well as contagious. The terms now mean the same thing." One of our ablest naval health officers in a recent article on quarantine uses contagious and transmissible as the same, and then the latter as equivalent to importation.

If these two words are thus undescriptive and in contact, which to many seem definable and separable, how much more can we criticise certain other terms.

Miasm, the general word for defilement, is one day made the term for any pollution of any kind, and the next defined, as the dictionaries define

[1] See *London Record*, October 11, 1878.

it, "a noxious exhalation or particle floating in the air," and so synonymous with the derivative use of infection, and much like the word malady.

Mal-aria, the term for bad air, not only betrays its mixed Latin and Greek origin, but is at one time made to denote a specific class of fevers and at another any infusion into air of any material supposed to be generated from without.

Fomes (fuel), or fomites, are loose words, for while indicating a substance capable of absorbing and retaining contagious effluvia, they are often used as if a person's hair, beard, breath, or his secretions might not themselves become absorbent and retainers of effluvia, and also without definite understanding whether they are mere carriers, or whether some process of change does not take place in the infective particle itself by virtue of its fomitic vicinage.

Zymotic is a term not physiologically correct. Importation is an imperfect word unless it is specified whether the infective particle is brought from a place, is generated on a ship, or is an exotic capable of reproduction and multiplication under specified native conditions. With reference to several words we use to denote conveyance, if you will read critically the article by Professor John Gamgee, to our Government, on the Texas cattle fever (1869), which was somehow infective, and remember that the cattle at least traveled without trunks, woolen garments, baggage, or other "fomites," we think several questions as to definition or limitation of technical terms will arise. Many use "germ" for both animal and vegetable organisms, and others only for animalculæ, while always referring to vegetable life under the term "fungus." Portability, endemic, epidemic, endemio-epidemic, catalytic, communicable, transmissible, contingent contagion, contagio-miasmatic, ideo-miasmatic, homo-miasmatic, epizoötic contagion, enzoötic contagion, — we need not multiply the list nor spend time now in details of illustration how these words are mixed, mingled, and confused even in treatises which start out with specified definitions.

I am sorry to confess that there is in this respect an ambiguity of terms in great contrast with those of the legal profession, and even inferior to that which is coming to make theological discussions more definite if not more harmonious. One of the chief benefits of medico-legal societies is that they help us to cull from law that which is most valuable to medicine.

This ambiguity is not only constantly causing our opinions and our discussions to appear as an indefinable jargon to the trained minds of other professions, but, what is still worse, is causing us to talk learnedly, and yet unintelligently, among ourselves.

And pardon me for the expression of the opinion that one of the very first things to be done as preliminary and essential to the close study of epidemics is to define terms in accordance with defensible meanings and restrictions, and to illustrate their use so that they shall not contribute to misunderstanding; or at least to agree among ourselves very definitely in what senses they shall be used by us.

This Association, or the committees which it may authorize, would have done large service to the interest of public health and State medicine if only they should give to epidemiology a plainer diction, and free us from those infelicities by which we do not fully comprehend each other, and are not comprehended by the well-informed co-laborers with us from other callings.

II. The next point we would note in the study of an epidemic is, as far as possible, to specify the diagnostic character of the disease we are investigating. To have identification there must be features. A knowledge of these is fundamental to the re-cog-ni-zance, and without this there must be confusion of ideas.

It greatly aids us in the study of small-pox that we are not liable to confound it with any other malady. In a disorder like yellow fever an embarrassment arises from the great difficulty of distinguishing between it and other forms of fever.

The frequency with which first cases are pronounced something else by eminent practitioners does not arise from their desire to conceal real facts, but from the acknowledged difficulties that attend the diagnosis. This is shown by the diversity of opinion during each epidemic as to the real number of occurrent cases, by the post-mortems of cases supposed to have been yellow fever, which show no distinctive lesions, and by divergence of view as to what constitute the distinct symptomatology and pathology of the disease.

If left as a subject to vary according to the individual opinions of those who have treated an epidemic thus called, and who base their judgment upon the aggregate of cases they have treated under this associated name, or to the descriptions of authors of theories and practice, or to the collection of evidence under the examination of any one season, we do not place ourselves in the position most favorable for review of the entire evidence which is to be considered.

Where a disease is *largely attributed* to a foreign port we need first of all *to have as a standard* the most precise details as to the foreign type, and then to compare and contrast with it the similar disease as found on our own shores.

If modifications are found we are the more able to separate the essential from the incidental, and to determine what permanent and characteristic features establish the identity.

Now that so many believe in the presence of two diseases at the same time, and not only in one being affected by the other, but in that closer union which makes a hybrid, and not merely a variation, we must study the original and unmixed types in their original homes in order to determine modifications.

It is by studying the plant in its native soil that we are able to give its most perfect natural history, and only so can we denote the changes which are made by transplantation.

Barton (1855) says: "My own opinion has long since been given that yellow fever is gradually blending itself with the ordinary diseases of the climate and season.

La Roche [1] tells us that yellow and malarial fevers may co-exist in the system. Daniel Drake recognizes that yellow fever here may be modified by "autumnal intermixture" or "alliance." [2] Pernicious, remittent, and malignant-remittent are terms which have been used by good authorities, and black vomit seen in them.[3]

Dr. Peters claims the yellow fever of the West Indies as a spotted typhus which the French grafted upon Martinique malarial fever.

It seems at first very graphic and helpful in diagnosis to draw sharp lines of demarcation, and speak of each infection as having its own specific poison. We are often told very plausibly that the offspring of sheep is sheep, and sheep only and that continually, and the inference is promptly made that diseases have an individuality which defies admixture. But it must be shown that the law is uniform, and that the analogy holds. Botany is showing us wonderful variations in the vegetable world, and great modifications of type. In the animal creation not only may a member of the equine species so far lose equanimity as to beget a mule, but there are other lines of suspicious hybridism. The study of epidemics has complications in these directions which cannot be dismissed by a general analogy or seeming illustration.

Since we have come to recognize such fevers as typho-malarial, to talk of diseases as arriving by importation, and yet their occasional or frequent generation *de novo*, independently of contagion,[4] and to be reminded "that several of these infective diseases do not *breed* true," [5] not only treatment but questions of origin and prevention turn upon this method of diagnostic study of epidemics in their birthplaces, and, if possible, by those who have treated them both in their native and adopted lands.

There is required a recognition of the incidental as distinct from the essential variations, of changes of type such as are alleged to make a mongrel or new disease, and in general diagnostic and differential analysis such as makes the study radical and the ability for it exceptional.

Another prominent requisite for the study of epidemics is that of—

III. *Ascertained and expert methods* for collecting facts, and in the act of their *collection* for sifting them as testimony.

If there are more "false facts than false theories," it is because of the errors of observation and experience, supplemented by a too rapid generalization of observations which thus take the place of the undistorted facts, and come to prejudice the observer.

Yet the facts of observation and experience are the only real basis of our study in epidemics. Hence we must have them. We must mass them, we must analyze them, and from them form our art of prevention and cure. They are the only currency that has value, and need to be handled and sounded by those who know the genuine ring from the alloy. Our prospect

1 See Foget.

2 Page 34.

3 See Dickson *On Yellow Fever*, 1845, p. 334, vol. i., p. 335; McArthur (p. 341), p. 438.

4 See Dr. Murchison and Jenner's *Nineteenth Century*, May, 1877.

5 See Dr. G. Wilson's *Handbook of Hygiene*, p. 351.

of value from them is to have such numbers that individual errors will be balanced or eliminated as unknown quantities, to know their authors so as to weigh them somewhat by the capacity for observation, and to have them examined by experts at a time when the clinical and historical details can be sifted, tested, and preserved.

A great epidemic strikes us much as does an outbreak of popular violence. There is the confusion of garments rolled in blood, a general *melée* having a possible record of real facts, but apt to be obliquely viewed by various observers, and not always well recorded by those who, under less pressure, would be more exact.

We always feel that so soon as the conflict is passed we would like to bring all the living and intelligent witnesses together as men are brought on the witness stand, and to reënact in medical matters what so often occurs in legal investigation, — judges upon the bench, the witnesses upon the stand, and expert lawyers to obtain the evidence. The witness tells his story, but that is not all. The court has before it his method and manner and in his very utterance judges of his ability as an observer.

The lawyers question and cross-question in a way that accords with the laws of evidence and with the classification of evidence. What is drawn out by the expert is really as much and often more of the *observation* and *experience* of the witness than *what he has otherwise testified.* Thus the fallacy of some observations and opinions is made apparent to the jury, and, perhaps, to the observer himself. Men understanding the laws of evidence, and accustomed to weigh and arrange facts, are thus able to present the observation and experience in complete record ready for study. They are not less inquisitive and formal with the intelligent or with those who are called as technic witnesses than with others who are more general observers. The great volume of fine-print testimony which results, with its pointed questions and precise answers, as elicited by opposing counsel and often from opposing witnesses, is far less a confused mass than if its collection had been more of voluntary utterance and less of extracted detail. The lawyer sits down to it with confident hopefulness, for the material is in what experience attests as the best shape for securing from it facts in such a form as constitutes evidence. To those about to adjudge the case, each witness, his credibility, his testimony, and all that bears on the securement of the truth, are presented so as to give the best probability of correct conclusion.

Would not we do well to put ourselves in a medico-legal frame, review our laws and methods of evidence, and seek to secure facts on some such plan? We cannot and we need not summon all clinicians to the high bar of a legal tribunal: but is it not in the power of State and national authorities, and, perhaps as tentative, in the power of this Association, to secure such evidence, before an expert jury of judges, as shall be something more than, and something in addition to, the usual collection of narrated clinical experience or avowed opinion.

A reaching out toward this method is not impracticable, and would present testimony, and the authority of testimony, in a way to impart to it far more weight as material for evidence than usual medical plans.

If the government had such a board in existence, we believe more valuable material could be secured than has been in previous epidemics. That is a forcible remark of Dr. Austin Flint, in a late discussion before the New York Academy of Medicine[1]: "Citations of authorities, reports of microscopical examinations, etc., will not meet the requisition, but what is necessary is an accumulation of facts which will enable all to study the subject and arrive at conclusions as well as those who were engaged in collecting them."

Such an accumulation of facts means something more than a mere numerical massing of observations.

It means facts collected in accord with the most approved methods of collecting evidence.

Some of the mass is historical, some clinical, some experimental, some the opinion of the observer. What every one may have to say may be worth being heard, but the mere listener or recorder of every thing that every witness has to say is not an adept in the *art* of securing evidence, or not sufficient for furnishing others with the material for their study.

We want the securement of the facts, the taking of the testimony, to be regarded as a distinct ability to be sought for in the study of epidemics, just as any special work needs special preparation.

Many a process of rigid reasoning has been clear and convincing only because the counsel, in the extraction of evidence, sifted the testimony until he reached strata of truth, the veins of which he could trace, and show their bearings and relations. Not a few have owed their eminence to this specific gift.

Benjamin Rush and Elisha Bartlett both advanced our profession so as scarcely to admit of comparison or contrast, each in his sphere a genius, and an authority. But as an expert in evidence we may illustrate by saying that the latter was far the superior.

We may quote from legal authorities and say that "aptitude for studying and understanding facts, coupled with powers of logic and communication, are needed, for most of the controversy is, What is the *truth* of the facts."

Facts have their alloy, which often needs to be refined out by expert processes. When we trust to collected *narratives* alone, even though it be clinical, we are not prepared to weigh evidence or reconcile testimony. There must be due examination had. Michael Faraday says: "I was a very lively and imaginative person and could believe in the 'Arabian Nights' as easily as in the Encyclopædia. But facts were important to me and they saved me." "I always cross-examined a statement until I could trust a fact." Medical experts for investigation of epidemics cannot be improvised, nor does the degree of M. D. certify competency. With rare exceptions, only minds early trained in logical methods can pursue this branch. It is for want of this, as an eminent legal author remarks, that we all have to note how rare a talent it is in men to report the substance of anything accurately. The facts and observations have to be studied inductively, deductively, an alogically, numerically, and then grouped rightly for study. This means very much.

[1] October 17, 1878.

IV. Quite germain to this head, and but for its essential character admitting of association under it, is the emphasizing of the point, that correct observation, experience, and facts in any one individual case, or in the case of any one epidemic of a disease, or in their *unclassified* condition, do not legitimately bring us to any definite conclusion. Having been properly collected and sifted they must now be arranged and studied by the severest methods of accurate analysis. Often the very hardest exercise of judgment in the skilled practitioner, especially in his dealing with epidemics, is to hold in abeyance his opinions, or any bias of conclusion, until he has gathered all his material, and so analyzed it as to make of it his own valuable, well-weighed judgment. Still harder is it to hold it under advisement until the body of facts presented by others has to a proper extent been ascertained and asserted, so that we can again present our own views with the certification given by the old Bible translators, — "With all former translations diligently compared and revised." The science or the art is not in the facts but in logical reasoning thereupon.

The deductions and conclusions from observation, experience, and facts, as they furnish the only sure foundation of our science and art both in preventive and administrative practice, must conform to the rigid requirements of all physical science. We cannot better or more briefly express what these requirements are than by quoting in substance three out of the six propositions with which Dr. Elisha Bartlett outlines Part First of his treatise on "The Philosophy of Medical Science."

(Prop. 1.) All right study of epidemics "consists in ascertained facts, or phenomena, or events; with their relations to other facts, or phenomena, or events, the whole classified and arranged."

(Prop. 3.) Our proper conclusion "consists in a rigorous and absolute generalization of these facts, phenomena, events, and relationship; and *in nothing else.*"

(Prop. 6.) "All classification or arrangement depends upon and consists in the identity or similarity amongst themselves of certain groups of phenomena or relationships; and their dissimilarity to other groups of phenomena and relationships. All classification or arrangements are natural and perfect just in proportion to the *number*, the *importance*, and the *degree* of these similarities and dissimilarities."

The author of "Practical Suggestions" expresses it when he says, "still more important than practical wisdom . . . . is a head for facts and details. Details, when numerous, must be systematized to be understood, that is, they must be decomposed into their component elements and then appropriately arranged. The particulars found to be like each other will be thrown together into groups. The groups will be next collocated in true rational order."[1]

John Stuart Mill speaks of that logic which contains "The principles of evidence and the methods of scientific investigation," and that is the logic we want in dealing with the facts of epidemics.

Who has not heard narratives of facts, as to epidemics, which, if presented

[1] J. C. Reed, page 369.

in a court would be non-suited as evidence by the judge without recourse to the jury. How many minglings of facts and parts of facts and opinions labeled as clinical or expert observations, would be deprived of apparent significance if only each constituency was grouped by itself.

From which it follows that observation, experience, and facts do not secure a reliable result until this kind of testing, study, and classification has been resorted to. When what each individual has contributed is presented for adjudication in legitimate shape and assortment, then not only the committee on collection, but all others, may proceed to form opinions which are likely to eventuate in correct practice, both in preventive and administrative service.

The entire process by which facts are accumulated, arranged, and estimated at their relative values and then held in abeyance until compared with a supplied series of facts by other observers, and the whole expressed in just and intelligent inferences, requires that the intellect be an instrument of precision, that the mind have that adjustment of balance which comes from long training in logical methods, as well as in the particular profession involved and that it be master of the rules of evidence, and know how to apply those tests which estimate the significance of facts.

It must not make verdict when possible sources of error have not been eliminated by a sufficient massing of cases. In questions of contradictory import, where numbers are involved, it must not speak of fifty or one hundred, or, it may be, five hundred cases, as the test, when by the ascertained law of probabilities it is possible to express in figures the real computed significance of the tabulation adduced.

Dr. Buchanan, for instance, when he had collected the facts in reference to the epidemic of enteric fever at Caius College, Cambridge, after securing his numerical data, in order to detect origin, sought the mathematical aid of Tutor Ferrers, and found that the *a priori* probability that the cause of fever did not lie in a common condition shared by the residents in college with the residents of town lodgings was three hundred and seventy-five to one.[1] The same method is applicable to series of alleged importations of epidemics.

It would have been far easier to have guessed that the probabilities were not over one in a hundred, but he recognized, as all students of epidemiology should, that where there are laws of evidence, or formulas for calculations of probabilities, it is gratuitous, presumptuous, and unscientific to give *opinion* until these calculations are had and have been estimated and placed alongside of the observation and experience.

Says Professor Venn[2]: "A knowledge of the law of arrangement is an enormous reduction of the labor of observation and experiment."

We are much in need of studying just such models as are to be found in the English Privy Council Reports in our inquiry about epidemics, since they illustrate some of the proper methods of testing alleged facts, of arranging them in their proper significance, and by methods of exclusion, of adjust-

[1] See New Series, No. 2, 1874, p. 69.

[2] *Princeton Rev.*, September, 1878, article on the "Foundations of Chance, Average, and Probabilities, as elaborated by Quintelet and Galton."

ment, and of calculation, giving to each in particular, and to the members in their jointed proportion, that significance which is just; thus presenting a body of doctrine in which all the vitals are packed in and all the limbs and members put on where they belong. Even a fact may be turned inside out, and so dressed up as to be quite presentable.

Our English word "tact" is alleged [1] to have had its origin from the Greek εὐστοχία as descriptive of that "peculiar skill or faculty of nice perception or discernment" [2] by which facts are touched, handled, assorted, arranged, and by skillful induction transformed into applied science.

The facts are neither science, art, or conviction, although so often accepted as such. Neither are they to be treated as plastic material, as is often done in order to mold them into the shape of our preconceived views. But as solid blocks of truth, needing to be put in their places, so that out of them shall come forth the temple of truth, the result of a clear medical faith, its perfection as much an evidence of what has been cast aside as a memorial of select, precious material found fit for preservation. It stands for the "reality of our nescience as well as of our science." [3]

Thus only are epidemics to be studied. We have elsewhere defended in certain cases the availability of hypothesis, of deductive reasoning, and of intelligent empiricism (in its technic sense), as aids in some processes of therapeutic investigation, but in the etiology, identification, and historical description of epidemics, they have no efficient aid to offer.

No more important work can be done by this Association at this critical and formative period than to improve the opportunity afforded for a defined and precise enforcement of the laws of medical evidence in studying epidemics, and of the way of dealing numerically with facts, and then to insist upon the main conditions, and see that these are illustrated by the whole conduct of the inquiry.

V. In the study of all epidemics, after having secured close analysis of the one nearest at hand, there must needs be careful collation and consideration of all testimony as to former outbreaks, with a decorous consideration of the opinions of the observers and contemporaries thereof. Each era of physical, and so of hygienic and medical science, may be expected to advance in its closeness of analysis and its ability to study and compare facts, and yet former records must be studied.

As to such an infection as yellow fever, and some others, there is much of statement of observation and experience which is handed down from one decade to another, as the quoted testimony of this or that observer, which needs to be dealt with by the crucial tests properly applied to recorded testimony. By such a process much that is now put in as contradictory argument would be dismissed as inadmissible testimony, and thus a great clearing and contraction of the mass of *so called* fact, observation, and experience be secured. Much of it could thus be disposed of as the attic furniture is disposed of at a time when the family is moving onward, and never again appear in the inventory of medical research to be palmed off as veritable evidence. On the other hand this kind of selective discern-

[1] See Blane, p. 95. [2] Webb. [3] Tyndall.

ment would enable us often to detect the grounds upon which former observers have entertained diversity of view, or make their opinions and evidence a firmer and more constituent part of the experience of the present.

It is unfortunate that in the controversies had as to yellow fever and some other epidemics there has been such divergence of view as has caused the most assertive positiveness, and made many a contestant to lose that deliberation of judgment and that courteous regard for the opinions of an opponent, which are necessary to a proper adjudication of evidence.

To any candid student of the literature of this or any one prominent epidemic, we think enough will appear to show the great honesty of purpose and the thorough conviction of eminent men who have taken the most radical and divergent views as to cause, origin, contagiousness, and methods of prevention.

The author of "Medical Logic" ends his elaborate review of yellow fever with this sentence[1]: "The question seems now to be brought to such a point that we may venture to challenge any candid, intelligent, and unbiased man, whether in or out of the profession, to open his eyes, and deny that this disease is contagious; and, if it be not, then has the author of this discussion lost every faculty of distinguishing truth from falsehood, of discerning light from darkness."

With equal sincerity and vehemence we find opposite views expressed by scores of intelligent witnesses, whom Dr. B. Dowler summons to show that it is neither "contagious or exportable."[2]

"The fact of a local origin," says Dr. Drake, "of some cases is as well established as medical facts generally are."[3] These and similar differences from the most eminent sources should make us exceedingly lenient of opinions, and prevent us from talking, as do many most reputable authors, of the "crazy hypotheses," "destructive treatment," and "monstrous etiology" of their contemporaries.

But this does not necessitate the endorsement of the views or confusion in our own minds because of respectable antagonism.

The fact of such divergence is just the reason why in the present study of epidemics we should correct certain errors of method both as to observation, and plans of recording and assorting facts.

In dealing with opinions as to former epidemics the most hopeful way is to seek out the grounds of these honest opinions, and of what may have been false experiences, not to compare things not comparable, to so analyze the facts as to show their incapacity as evidence, and to explain on a strictly logical and "law of evidence" basis why the observers were mistaken, rather than to indulge in intense nouns and intenser adjectives, to express our disrespect for their authority. Thus we believe we can clear the past of much that is dubious in its record, and so conduct and certify our methods as shall secure progress toward uniformity of conviction, or such well defined lines of divergence as shall give us definiteness in defense or besiegement.

VI. Next we beg to express the view that in the study of epidemics very much of precision can be gained by adopting to a prominent degree a catechetical method of investigation.

[1] Sir Gilbert Blane, page 187. [2] Page 16. [3] Page 296.

We have already expressed a conviction that it is well when in the analysis of an epidemic we are able to meet, by expert examiners, the living witness and examine and reëxamine evidence with all the advantages for arrival at the truth which forensic methods secure. The ablest lawyers do not like written testimony in capital cases. But as this cannot always be convenient, the next most incisive, separative, or discerning method is to propound questions, which by their definiteness do not admit of vague generalities in reply, which not only fasten the replicant to a specific declaration of view, but if followed up require equally definite reason for the view taken.

The first meaning of the word catechetical is instruction. By questions asked intelligently, and with a following of the essential as distinct from the incidental, the answerer himself often comes to know what his opinion involves, to a degree which would not occur in his usual unquestioned detail of his observation and experience. "Searching into every particular," says Quintilian, "we sometimes discover truth where we least expected to find it."

Thus the doctrine of unexceptional importation of yellow fever, of this origin, and this only, and this by necessity, is embraced by some who have never been over the opposing testimony, or had presented to their minds the inquiry how it became an *acclimated* disease in the West Indies, or compared conditions of heat, moisture, deposit, and isothermal similarity, or thought to consider or explain the apparent *de novo* origin at sea on long voyages from healthy shores, where the foulness of the forecastle on the computation of probabilities was a much more probable *de novo* cause than the conveyance of an infective particle. While we may not be satisfied as to the evidence we must be cognizant of it.

Questions as to contagion which would lead the person to define his own definition of it, or which in their consecutive putting would show in full what the acceptance or rejection of the opinion involved, would be so suggestive as to lead many to a closer observation for facts, or to think of explanations, which would not render necessary the conclusions at which they had arrived. Thus men are lead to discern between their facts and their conclusions upon facts, and thus to classify their facts, their observations, their experiences, and their reasoning each by itself under its own appropriate heading. We are thus all healthfully taught to investigate our own experience, and to deal with our professional selves in a logical and informatory way.

The categorical or proposition method is somewhat allied but not so available for definiteness for the average medical mind. Unequivocal questions compel unequivocal answers.

A great advantage of the interrogatory method is that in the formation of our question book we are able to avail ourselves of the best trained minds and the most competent authorities and really in the inquiry itself to formulate an amount of interrogatory exactness so directive, so suggestive, that in it we make most valuable progress toward the proper study of our subject.

A dozen rightly selected men making of this a study, pointing their inquiries as would a Phillips or Greenleaf, and perhaps now and then aided by a question furnished by some medico-legal or suggestive civic mind, would give the outline for a study of an epidemic which would serve as an "index rerum," a syllabus which of itself would be a forward march, and not only extract evidence, but help to educate observers in the science and art of observation. As Lord Bacon puts it, "Prudens interrogatio quasi dimidium scientiæ," which he translated, "A faculty of wise interrogating is half a knowledge." Erskine and Brougham, Pinkney and Choate, owed much of their marvelous power to their success in thus eliciting truth. Be assured there is a science and art in this particular not possessed by every man who treats a case, who removes a tumor, or who is skillful in the ordinary sense. It deserves to be studied and practiced as a specialty as much as do some of our more exquisite specialties. There is, in fact, room for a treatise on the philosophy of medical investigation. Such questions need to be elaborated with thorough fitness, and, like those of Surgeon Billings in his plan of sanitary survey, should be the result of most careful comparison and induction, aided by many minds and much experience.

I can only say that in turning my personal attention to this as a self-educating process, and in an attempt to question so as to obtain that embodiment of comprehensive answer which should express the truth, I am led to know more than before how much I have to learn in this direction, and how much I need this kind of help and exercise, in order to secure reliable results and to consolidate material into classified and reliable art.

As there has been a Westminster body of divines in theology, and as in law such men as Cox, David Paul Brown, and J. C. Reed have felt it necessary to discuss in large treatises the proper way of questioning and of eliciting evidence, I believe we, too, may profitably expand in the same direction. In the authorities I have referred to outside of technical directions there are many excellent suggestions and instructions worthy of the study of our "Masters in Chancery" who must receive and review medical evidence as to epidemics.

One other collateral point and I will no longer ask your forbearance.

VII. In the study of epidemics we need more material support.

It must be gratifying to every member of the Public Health Association to recognize the increase of interest which even previous to the pressure of our appalling affliction has been evident. Our trial has given new pith and power to this popular sentiment, so important in such a cause as this, and has educated the public mind up to higher demands in the elaboration of a preventive as well as a healing art.

The press, with its wonderful corps of ready journalists, has ever been the foremost friend of this great public welfare. Very many of the editorials and of the letters which have appeared for the last half dozen years in our most prominent issues have advocated the claims of public health administration in a spirit and with an ability fully abreast with our best lines of defense, and have urged home upon municipal authorities and the general public the weighty concerns of this fundamental political economy. Perchance the time has come to press home upon the General Government the need of national organization on a working basis.

But in doing this we always feel as if we were in danger of making of it an ultimate reliance. To the government it is rather a question of necessary self-protection, and can only result in efficient service when its need is felt as an administrative act. Then it will move — but move as governments generally do in all army, navy, or marine matters that relate to medical service — rather under this code of disbursing necessity than that of preparatory and preventive economy.

It is greatly to be desired that with an urgent and sustaining popular sentiment, and by the preliminary advancement of State and voluntary efforts, there should be such national aid as can collect and concentrate all available information.

After all, the interest of public health and the study of epidemics will for the next quarter century have to depend largely upon professional enthusiasm, voluntary associations, and private munificence.

In the spirit of the letter of the French minister of agriculture and commerce, just previous to the Paris Quarantine Convention of 1850, it must still be said that there are "questions of public hygiene which the government can not decide and which can only be resolved either by the Academy of Medicine or the Academy of Sciences." Lord Derby was right when he said, "no sanitary improvement worth the name will be effected, whatever acts you pass, or whatever powers you confer upon public officers, unless you can create a real and *intelligent* interest in the matter among the people at large. The State may issue directions, municipal authorities may execute them to the best of their power, inspectors may travel about, medical authorities may draw up reports, but you can't make a population cleanly or healthy against its will, or without their intelligent coöperation. . . . . This is why of the two sanitary instruction is more important than sanitary legislation." The society for the diffusion of useful sanitary knowledge and the science and art study of prophylactic methods cannot yet put its chief dependence on national acts. Our republican system must have a large popular going before, as well as a popular following, in all such attempts. The drawback upon professional enthusiasm which is not destructive and yet embarrassing is that the student cannot physically maintain himself or his dear ones by enthusiasm in this expensive luxury.

Dr. Bellows recently condensed a large experience by saying that he could assure all sanitary zealots that the country and society will pay very little for preventive, and very largely for relieving and curative skill. Hence it requires philanthropic enthusiasm for the same profession which can command the latter with its rewards, to devote itself to any large degree to the former with its self-denials.

Voluntary association has its delightful unions and its inspiring results, but at length many an ardent worker yields to the pressure of pecuniary disability or business inconvenience.

But in the study of epidemics, and of the preventible causes of all disease, is there not an invitation to private munificence which may modestly but imploringly present itself to the sympathy and consideration of all noble-hearted opulence.

Let the Government, and the States, and the Association, and the private laborers go on in their noble work, but as State institutions do not prevent the hospital and other munificent charities endowed by private liberality, so may we not hopefully look in this noble effort for the nation's health, for the commonwealth, to sustaining aid from individuals.

In this great country there ought to-day to be in some central city an academy of sanitary science, where could be pursued all those branches of technic investigation which bear upon the preservation of the public health, where could be gathered all those sanitary appliances which in such numbers are needed in our modern dwellings and our crowded cities, and under whose superintendence in time of sore disaster could issue forth organized bands of skilled workers, some ready to observe, some to experiment, some to alleviate, and all to administrate in the common interest of that unity of science, philanthropy, and art which always means personal comfort and the public welfare.

The thorough work of sanitary science involves large expense. No private laboratories can compass it. So long as medical colleges rest on students' fees, their only corporate relation to sanitary advancement will be that of complimentary and patronizing approbation, with individual exceptions of personal unofficial zeal. Under the present organization of medical education, we have more to hope from a university which makes of public health a special science course, as does the University of Edinburgh, and as we hope Johns Hopkins University will, or from an institution like the Smithsonian, that investigates without graduating pupils, or from the *munificence of individuals* who by some golden enabling act may make it possible for workers in this department to be sustained. We must appeal, and shall not appeal in vain, for pecuniary aid like that which has been given to educational institutions or remedial retreats.

Already we have a precious harbinger of hope, and are here assembled as a Public Health Association, partly by the beckoning wand of one whom generations henceforth shall count happy because she has provided the material aid most of all needed in a direction heretofore overlooked and yet more fundamental and hopeful than all beside. It is the hand of a woman that has extended itself to the distinguished chief of our national merchant marine, — the carrier dove that has saluted the American eagle with precious gifts for the *saving* art, in order that to pestilence we may say, Thus far, with a mandate that shall be obeyed. Many daughters have done virtuously, but thou excellest them all.

It is a true devotion to science and charity, — both maids of honor to a sacred royalty.

It is like Mrs. Somerville, of whom Sir R. L. Murchison, at the presentation to her of the Patron or Victoria Medal, in 1869, said: "This admirable woman, now in her eighty-ninth year, is yet occupied in scientific labors."

It is like Florence Nightingale, who, in middle life a secluded invalid, is still ever busy in her precious offices of life-preserving love. It is woman's work for woman, for if one sex more than the other suffers from such disasters, it is woman, whose kingdom is her family and whose palace is her home.

An example has been set which should elicit the attention of every woman and of every beneficent man of wealth, and of every merchantman seeking goodly pearls, in our land, and should lead every physician to look about him to interest his wealthy patrons in this cause, on such plan as the donors may suggest, and under trustees competent to the trust.

We are not without hope that the minds of those of both sexes rich in philanthropy, rich in the appreciation of sanitary science, and rich in the wealth which is most precious when consecrated to such purposes, will be so moved by these weighty interests as that the Association shall be able to coöperate in some method by which *Hygeia*, the daughter of Æsculapius, shall yet have her temple, to which woman shall bring better offerings than the consecrated tresses of their hair, and men give more practical and productive gifts than did Pericles when he erected a statue to her honor.

Thus, my brethren of all professions and of all civic rank, I have ventured to suggest the direct, and *one* of the collateral, methods by which we may hope to advance in our study of infections until they shall ere long be pronounced as within the power and duty of human control.

No one can be more conscious than myself that much remains to be added to make a perfect outline, and I have almost felt it rash to have ventured thus far on so weighty a theme. But we are here to express in humble sincerity our common convictions, in the hope that they will be at least suggestive, and urge on others more competent to help us onward and upward in this the most *rigorous* and needed study of sanitary science and art.

VI.

HISTORY OF THE IMPORTATION OF YELLOW FEVER INTO THE UNITED STATES, FROM 1693 TO 1878.

ITS INTRODUCTION IN NEW ORLEANS IN 1878. MEASURES OF DISINFECTION USED TO CHECK ITS PROGRESS. ABSOLUTE NON-INTERCOURSE THE ONLY MEANS OF PREVENTION.

A PAPER READ AT THE MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION, RICHMOND, VA., NOVEMBER 21, 1878.

BY SAMUEL CHOPPIN, M. D.,

President of Board of Health of Louisiana, Second Vice-president of American Public Health Association.

MR. PRESIDENT AND GENTLEMEN OF THE AMERICAN PUBLIC HEALTH ASSOCIATION, — Coming from the chief city of the South, sorely stricken by the recent yellow fever epidemic, and which, in her distress and sorrow, experienced so much real sympathy and surpassingly generous material aid from all parts of our common country, I take pleasure, before making the observations I shall have the honor of submitting to this body, in expressing here through the officers and members of our Association, to the people of the States from whence you come, the sincere gratitude of the citizens of New Orleans, and of the State of Louisiana, for the unexampled and munificent contributions of money made to the sick and distressed people of that State by our fellow citizens of the other States of the Union, and also for the many assurances of regard and fellowship which accompanied these contributions. I beg to assure you, gentlemen, that the happiest effects will result from these friendly and noble acts, in their tendency especially to strengthen and cement the ties which unite these States together as the members of a common Union, founded upon justice and confidence and mutual interest.

My personal thanks are due to you, gentlemen, and to our distinguished President, for the courteous invitation which I had the honor of receiving, to be present at these deliberations, and to take part therein, and I now proceed to submit certain facts and observations concerning the history and origin of yellow fever in the United States, and especially in my own State, and concerning the system of quarantine employed to protect us from its ravages, and which at this time needs to be amended, improved, and more strictly enforced in our part of the country; believing, as I do, that quarantine can be made effective to the complete exclusion from this country of this terribly destructive disease.

The immense loss of human life in the southwestern States by yellow fever the past summer, estimated approximately, to exceed fourteen thousand souls, and the almost complete stoppage of commercial intercourse between the healthy and the unhealthy sections of the United States involving a very large pecuniary loss, difficult of estimation, call loudly for the consideration of the ablest men in the land, and especially for that of the profession whose lives are devoted to the study of the diseases, epidemic and other, to which the people of this country are subject, for the purpose of ascertaining whether or not yellow fever be of foreign or of native origin; whether or not there be any means of confining it and preventing its spread, if it be indigenous to the soil; and, in the event of the conclusion being arrived at that the disease does not originate in this country, the ascertainment and adoption of the best and most effective measures of preventing its introduction from abroad. Each theory, it must be admitted, has powerful advocates, and there are facts cited by them in support of their respective ideas, which are not altogether easy of reconcilement. Still, I think it can be shown that the weight of evidence preponderates in favor of the proposition that yellow fever is an exotic disease and has invariably, on its appearance in this country, been traced to a foreign country and a foreign germ. Certainly there is no authentic instance on record, known to me, where the disease has been carried *from this country to another*, whilst there are numerous instances, well known to every one acquainted with the history of yellow fever, of its being carried from tropical countries and islands lying many hundred of miles south of the United States to southern ports of the Union, as well as to northern ports, such as Boston, New York, and Philadelphia, and to European ports. In fact, history gives no other account of the transitions of the disease. America, *i. e.*, the United States, nor any section of it, is the *habitat* of yellow fever. That distinction belongs to the West India Islands, Atlantic and Gulf Coasts of South America, and of South Africa, and of Mexico, and perhaps other regions of the far South. The only distinction that can be given to Louisiana and the other southern States of the Union from those of the east and west, is that, lying near the tropics, their climate partakes of the characteristics of tropical countries, and the diseases peculiar to the latter, therefore, more easily find temperature and other conditions suited to their reception and spread.

In the language of the great scientist, Prof. John Tyndall, "If the special matter or germs of epidemic disorder be not present, a corrupt atmosphere, however obnoxious otherwise, will not produce the disorder. But if the germs be present, defective drains, cesspools, decomposition of animal and vegetable matter, heat, and moisture may become the potent distributors of disease and death. A corrupt atmosphere may promote an epidemic, but cannot produce it. On the other hand, through the transport of the special germ or virus, disease may develop itself in regions where the drainage is good, and the atmoshere pure. It you see a new thistle in your field, you feel sure that its seed has been wafted there. Just as sure does it seem that the contagious matter of epidemic disease has been transplanted to the place where it newly appears. There is nothing in pure chemistry which resembles the power of self-multiplication possessed by the matter which produces epidemic disease. If you sow wheat, you do not get barley; if you sow small-pox, you do not get scarlet fever, but small-pox indefinitely multiplied, and nothing else. The matter of each contagious disease reproduces itself as rigidly as if it were cat or dog." And so does yellow fever.

Yellow fever appeared for the first time in New Orleans in 1796, while it had previously appeared in Boston in 1693, in Philadelphia in 1699, in New York in 1702, in Norfolk in 1747, in New Haven, Conn., in 1742, in Providence, R. I., in 1794, and in Baltimore, Md., in 1794; also in many other northern and eastern ports. In the northeastern portion of America this disease was therefore older than the city of New Orleans.[1] "Yellow fever," says Dr. Dowler, "had approached New Orleans sixteen years before the city was founded, having appeared at Biloxi in 1702, ninety miles distant, a French military station and settlement, founded by Iberville in 1699; and also at Mobile three years latter. It appeared as an epidemic in New Orleans for the first time in 1796. It was considered by the people as of foreign origin."

Another great and authoritative writer says: "The fever which prevailed in New York in 1702, was said to have been imported from St. Thomas, West Indies; it appeared again in Philadelphia in 1741, and in New York in 1745; and it was the universal opinion that these epidemics were due to foreign importation from the West Indies, and no one thought of giving the disease a local origin."[2]

The West India trade was destroyed after the next epidemic in Philadelphia, in 1762, by some acts of Parliament known as the "Commercial Monopoly," and by the subsequent war of the Revolution. With the return of peace came a renewal of the West India traffic, and with it the yellow fever again; appearing in New York in 1791, and in Charleston and Philadelphia, in 1793.[3] The same author says: "The College of Physicians in Philadelphia gave it as their opinion, in an official report to the governor of the State of Pennsylvania, that the epidemic of 1793 owed its origin to importation from the West Indies in July, many vessels having arrived from infected ports in that month."

"It prevailed again in Philadelphia in 1794, in New York in 1795, at Providence, R. I., in 1797, and again at Philadelphia in 1797. The College of Physicians again traced it to two infected ships, which arrived in July, one from Havana and one from Port-au-Prince. The same year it prevailed at Baltimore, the first case occurring having just arrived from Phildelphia. In 1798 the most extensive and fatal epidemic occurred. It broke out in Boston, Philadelphia, and New York, and raged with great mortality.

[1] See Dr. Bennett Dowler's pamphlet, published in 1854, entitled, *Tableau of the Yellow Fever of* 1853, *and Historical Sketches of the Epidemics of New Orleans since their Origin in* 1796.

[2] La Roche *On Yellow Fever*, vol. i., pp. 60, 61.

[3] Vide *Quarantine on the Southern Coasts;* a Report to the Secretary of War made in 1862 by Harvey E. Brown, U. S. A. Assistant Surgeon.

In the two latter cities its introduction was most positively traced to the arrival of infected ships from the West Indies. Two points are worthy of note, in connection with the epidemic: one, that the authorities of Philadelphia had become frightened at the yearly appearance of the disease, and had placed the city in excellent sanitary condition, compared to what it had been previously, by a careful and vigorous system of police, and *yet entirely neglected any quarantine measures;* and the other, that the authorities of Baltimore established a quarantine, not only against vessels coming from the West Indies, but also against persons and baggage coming from Philadelphia, and entirely escaped the disease."[1]

The first *official* mention or record of the *importation* of yellow fever into New Orleans, that I have found, is contained in the report of the Board of Health to the Legislature of 1823, dated January 15, 1823.[2] This report holds the following language concerning the epidemic of the preceding year, 1822, at New Orleans: "The researches made by the Board at the commencement of the late epidemic lead them to believe that the yellow fever *was imported,* toward the end of August last, by a vessel from Pensacola, arrived at the Basin of Canal Carondelet; and attention was first attracted to the disease in a family of the name of Lynch, passengers in said vessel. This family, of which every member but one fell victims to the yellow fever, had removed to Bienville Street, where the disease first spread, and from here extended through the city. The Board of Health believed it to be their duty to do away with the impression made by interested persons, to induce a belief in the inutility of the powers which you have so wisely conferred on the Board, for the establishment of quarantines, which these persons wish to see destroyed. This opinion is diametrically opposed to that of the Board of Health, who believe that the yellow fever is contagious, and who believe *that the establishment of quarantine is necessary to prevent its introduction.*"

In 1823 a quarantine law was passed by the Legislature of Louisiana, establishing a lazarette and quarantine five miles below the city. It proved a mere obstruction to commerce, without producing any desired result, and was repealed in 1825. Yellow fever reigned annually every summer with more or less malignity. Between the hibernation of the germ and importation of the disease from abroad, the city of New Orleans never was free from the scourge, and our native population was made to believe that the disease was indigenous. In 1829, violent epidemic; 1830, epidemic; 1832, epidemic; 1833, violent epidemic; 1834, epidemic; 1835, epidemic; 1836, few cases; 1837, violent epidemic; 1838, few cases; 1839, violent epidemic; 1840, none; 1841, violent epidemic; 1842, epidemic; 1843, epidemic; 1844, mild epidemic; 1845, epidemic; 1846, few cases; 1847, violent epidemic; 1848, epidemic; 1849, few cases; 1850, 1851, 1852, few cases.

It was alleged and generally believed that our pestilential fever was imported from Rio Janeiro. That a ship, the *Siri,* Captain Higgins, did arrive from Rio on the 10th of May, 1853, and that the captain lost, before leav-

[1] See Brown on *Quarantine on the Southern and Gulf Coast,* pp. 12 and 13.

[2] See Dowler, p. 20.

ing Rio, his wife, son, and some of his crew, is a fact that cannot be controverted; but no case of yellow fever occurring in New Orleans could be directly traced to this ship.

The first death of yellow fever in 1853 happened on the 28th day of May, at the Charity Hospital, of which I was house-surgeon at the time. The subject was one McGuigan, an Irish emigrant, who arrived in New Orleans on the 9th of May, on the ship *Northampton*, from Liverpool direct. This man was sick four days before entering the hospital, which was on the 27th, and died on the 28th. The *Northampton* sailed from Liverpool about the latter part of March with over three hundred passengers, was forty-five days on her passage, stopped nowhere between Liverpool and this place, and was moored on the 9th of May, at the foot of Josephine Street, in the Fourth District. McGuigan had never left the ship. Between the time of McGuigan's sickness, and the 14th of June, when the *Northampton* sailed for Liverpool, a boy on board, named Richardson, fell sick with yellow fever.

How the *Northampton* was infected, is proved by the following facts: On the 17th of May the ship *Augusta*, direct from Bremen, with over two hundred passengers, sixty-six days on her voyage out, arrived in New Orleans, and took her position at the wharf alongside of the *Northampton*. "At the mouth of the Mississippi river, she took a tow in company with the ship *Camboden Castle*, a vessel direct from Kingston, Jamaica. This latter vessel, while in that port, lost her *captain* and seven of her crew by yellow fever. During the voyage up the river, there was free communication between her decks and the passengers on the *Augusta*, the crew of the one and the passengers and crew of the other freely intermingling. On the nineteenth of May the *Camboden Castle* was dropped at Post 27, directly opposite the Water Works, and in company with the *Niagara*, the *Saxon*, and the *Harris V. Fuller*, while the *Augusta* was carried some thirteen wharves higher up, and dropped alongside of the ship *Northampton*.

As early as the 20th of May, Dr. Schuppert, a highly respected physician of New Orleans, states that he treated on board of the *Augusta* several of her crew with all the malignant symptoms of yellow fever. Several of the men employed to load the *Northampton* sickened with the yellow fever, and, returning to their boarding-houses, established foci of infections in different portions of the city, and the disease became epidemic.

In presence of these facts, Doctor La Roche's labored efforts to prove the local origin of yellow fever in New Orleans in the neighborhood of Gomely's Canal, from some cases which were supposed to have been "yellow fever," falls to the ground.

Dr. Fenner (at page 12) mentions the ship *Camboden Castle* as having arrived at New Orleans from Kingston, Jamaica, from which port she sailed on the 2d of May, having lost at Kingston seven (7) of her crew from yellow fever. At page 70 Dr. Fenner gives the testimony of Dr. William Rushton, of New Orleans, as to the origin of the fever in 1853. "He thinks it was imported, and was identical with the African fever. Is doubtful whether it ever originates in New Orleans. Thinks an effectual quarantine would keep it out." Dr. Rushton was a medical man of high standing, and had practiced his profession in Rio Janeiro. He was, therefore, familiar with the yellow and other fevers of that climate and locality.

In reviewing the histories of the epidemics of the years 1853, 1855, 1858, 1867, and of the localized visitations of the years 1871, 1873, 1874, 1875, and 1876, in New Orleans, it is not difficult to decide that their origins were due, directly or remotely, to foreign importation of the germ.

In Florida there never has been an epidemic of yellow fever which could not be demonstrably traced to direct introduction from abroad. The epidemic of 1821 at St. Augustine was imported from Havana; that of 1822, at Pensacola, was imported from the same place; that of 1825, at Pensacola, from the West Indies; that of 1834, at Pensacola, was imported in war vessels; that of 1839, at St. Augustine, was carried there from Charleston, South Carolina; that of 1839, at Pensacola, was carried from Mobile and New Orleans; that of 1841, at St. Augustine, was imported from Havana; those of 1842, 1843, 1844, 1845, 1846, and 1847, at Pensacola, were imported in war vessels; that of 1853, at Pensacola, was imported from Tampico; those of 1862 and 1865, at Key West, were imported from Havana; that of 1867, at Pensacola, was imported from Jamaica; that of 1869, at Key West, was imported from Cuba; that of 1871, at Cedar Keys and Tampa, was imported from Havana; those of 1873 and 1874, at Pensacola, from Havana, as was also the scourge which devastated the little seaport town of Fernandina in 1877.

In 1862, during the war between the States, the yellow fever epidemic of Wilmington, N. C., was due to the introduction of the germ from Nassau by the blockade steamer *Kate*. In 1867 it certainly came to us from Texas, where it was imported by the *Margarita* into Indianola. She sailed from Vera Cruz on the 11th of May, and arrived in port on the 21st. A Mr. Lechard, a passenger on board, had a lot of second-hand blankets disposed of at auction, to which was attributed the rapid spread of yellow fever. The first cases were a drayman named Hunter, and a lad named Cook, who hauled the blankets to the place of sale. A Mr. Andrews certifies that he, together with a Mr. Duke, examined the blankets at the auction room on the 25th of May. Three days subsequently he left for his home on Haynes Bay, and the same evening was attacked by yellow fever. His companion, Mr. Duke, was attacked the day afterwards and died. A negro woman, who attended on Mr. Duke, was seized fourteen days afterwards, and died. The fever was soon communicated to Galveston.

One of the first cases in New Orleans was T. B. Bonnaman, who arrived upon the steamer *N. G. Hewes*, from Galveston, on the 20th of June, to which place he came from Indianola. He had a chill at Galveston on the 19th, and died at New Orleans on the 26th, of June.

In 1869, the report of the Board of Health for that year shows that there were three deaths from yellow fever in New Orleans. One of the cases was taken sick on July 17, having been only two days in the city. He was only twelve days from Havana. On September 30 the captain of the British ship *Belgravia*, from Liverpool direct, and two boys of his crew were attacked. One of the boys died. On September 19, two cases appeared on the steamship *Trade Wind*, and one of these died.

In 1870, the report of the Board of Health for that year (page 9) mentions 587 deaths; page 74, one case, named Dinslow, being that of an officer of the steamship *Agnes*, recently from Honduras. She arrived at the port of New Orleans on May 16. Dinslow died June 2. On page 41, the same report says that "from the course and nature of the yellow fever which prevailed here last summer, it is very evident that —

"1st. A continuation of the quarantine laws to prevent its importation; and,

"2d. A strict enforcement of the 'nuisance ordinance,' as adopted by the Board of Health, August 12 and 17, 1870, would protect the city effectually against any future epidemics of yellow fever."

In 1871, the Board of Health says: "As much has appeared in the public prints as to the uselessness of quarantine regulations, the Board express their opinion to be decidedly in favor of the continuance of those regulations and thorough enforcements."

In 1872, the Board of Health say, in their report for that year: —

"From the facts before it, the Board of Health do not feel justified in recommending any change in the existing regulations relative to the method or duration of quarantine against yellow fever. The scientific sanitary desideratum in quarantine is certain, rapid disinfection of the loaded vessel by agents not inimical to craft or cargo, and it is in this direction that inquiry in the immediate future should be made."

In the same report, that of the Board of Health for the year 1872, the following observations are found (page 96): "The yellow fever which visited our city during the past year (see special report Sanitary Inspector of Fourth District) commenced, as in the previous year, in one of the most healthy and cleanly portions of the Fourth or 'Garden' District, which is the best part of the city. The first case occurred August 28. Although the most careful inquiry was made, the disease could not be traced to its origin or importation."

In the report of the Board of Health for 1873, it is stated that the barque *Valparaiso* appeared at the quarantine station on the Mississippi River on June 24, eight days from Havana. On June 26, no cases of yellow fever having occurred on board since she left Havana, she was allowed to come up to New Orleans. On the 4th of July a case of the fever appeared on board the ship, in the person of the mate, who was employed in the hold of the ship, directing the storage of the cargo; and from this vessel apparently sprang the infection of the fever which afterwards extended widely. The Board of Health add that without doubt the fever was introduced in 1873 by the barque *Valparaiso*.[1]

This germ infected Memphis and Shreveport, and was the cause of the pestilence which devastated these two cities in 1873. In almost every year since 1872, down to the present year, there have been cases of yellow fever brought to New Orleans from Havana or other ports south of us, while there is *no evidence of the disease having originated here.*

On the 22d of May, 1878, the sanitary condition of New Orleans was as

[1] See the cases detailed in paper indorsed "Quarantine at New Orleans in 1873."

good as it generally is at that season of the year. Malarial fevers were not more prevalent than usual, and there was not a single case of yellow fever in the city. On the morning of the 23d of May, the steamship *Emily B. Souder* arrived and was moored at the foot of Calliope Street.

The first cases of yellow fever at New Orleans in 1878 undoubtedly were two of the officers of the above steamship, namely, Clarke, the purser, and Elliott, one of the engineers. Clarke was ill when the vessel reached quarantine, but managed to pass inspection as suffering merely from neuralgia. Quite lately it has transpired, through the inquiries of the Yellow Fever Commission, that he boasted, after arrival at New Orleans, that he had "beaten the quarantine doctor." Be that as it may, he went ashore sick, when the vessel reached her wharf May 23, and two days after he died, with symptoms which belong unmistakably to yellow fever, at a house on Claiborne Street, near Conti. He was attended both aboard and ashore by a physician long resident in this city, and quite familiar with yellow fever; an investigation of the case at the house where he died showed that the treatment was more suitable to yellow fever than to any other disease; still a burial certificate was given of death by a malarial fever. This case was not brought to the notice of the Board of Health by any direct communication, official or otherwise, but from information received through rumor. It is a significant fact, in connection with Clarke's case, that he died at 2 o'clock, A. M., and was buried at 10 A. M., the same day. No public announcement of his death was made until the following Sunday.

We here append the report of the investigation of Clarke's case by Dr. A. Landry, Sanitary Inspector.

"OFFICE OF SANITARY INSPECTION, SECOND DISTRICT.

"SAMUEL CHOPPIN, M. D., *President Board of Health.*

"*Dear Sir,* — I have the honor to hereby transmit to you all the information I have been able to gather relative to the illness and death of Jno. E. Clarke, Esq., late purser of the steamship *E. B. Souder.*

"Clarke was a man of strong complexion, of about forty-eight years of age, and who had long been employed on vessels plying in the Gulf of Mexico. His ship, the *E. B. Souder*, reached here on Wednesday, May 22, he staying thereon until the following morning, the 23d, when, at 9 A. M., having been unwell since the day previous, he left the ship to go to house No. 65, on Clairborne Street, occupied by a colored family, where he immediately went to bed. At that time he was suffering from an indescribable state of uneasiness and restlessness coupled with intolerable headache and pain in the loins. Clarke reached the house in company of Dr. Drew, who, it seems, was not his regular physician. Dr. Drew, the inmates of the house state, prescribed something to be taken by drops, if at 12 o'clock Clarke's regular physician had not called. At 12 o'clock, the regular physician not appearing, the prescription left by Dr. Drew was administered without any noticeable effect.

"Dr. Drew detected fever, stating, however, that it was not dangerous and left, coming again only the next day, Friday, the 24th, at 10 A. M. Two or three hours after reaching the house he was never to leave alive, that is, in the forenoon of Thursday, the 23d, Clarke urinated, emitting a small quantity of *greenish* liquid, and from that time until death never again urinated.

"During the whole day of Thursday, the 23d, he was constantly in a state of unbearable agitation and suffering, which nothing could relieve. The women who nursed him tried their utmost to procure him some rest, but in vain; they tried, of course without result, poultices of hops, saturated with vinegar, placed on the hypogastric region, to facilitate urinating. Besides a constant headache, with pains in the loins, the patient suffered incessantly from a weight upon his chest and stomach, accompanied with nausea and difficulty in breathing, but no vomiting. Nothing could relieve him of this sensation.

"During the whole of Thursday, the 23d, and the forenoon of the 24th, the patient suffered tortures, resulting from an intolerable sensation of intense heat. There were some slight remissions, but none sufficient, however, to bring on perspiration. The facies was red, but without traces of jaundice, either on the skin or sclerotic. Foot-baths, and mustard plasters applied from time to time over the whole body were tried. No information relative to the frequency or nature of the pulse. On Friday, the 24th, Dr. Drew called at about 10 A. M., prescribing a blister, which he had applied at the pit of the stomach. At 11 A. M. the patient is without fever. During the day he takes some lemonade but throws it up, without effort, however. No traces of Black Vomit. During the afternoon the patient is better and feels quieter. Dr. Drew had prescribed iced champagne, to which the nurses had objected, as being inopportune and even dangerous; the Doctor insisting, Clarke took a little, which he kept. Later on, during the afternoon of Friday, Clarke, still feeling better, asked for food. *He was given some chicken broth, which he relished, declaring it excellent.* Nevertheless he only took a few spoonfuls of it, not seeming to care for any more.

"Notwithstanding the apparent improvement of Friday morning, the patient becomes again restless towards evening; the evening itself is unfavorable, the night slightly better, with short spells of sleep. But at 1 A. M., Saturday, Clarke is taken with a first convulsion, so violent that he is almost thrown out of bed; then comes a period of relative calm and delirium; then a second convulsion and again calm and delirium; then a third convulsion, during which he passes away, about half past two o'clock, A. M. Immediately after death the body began to assume the typical icteric tinge. The nature, but more especially the *ensemble*, of symptoms, the short duration of the illness, the suppression of the urine, the fancy for food (always a fatal sign) shortly preceding the end—death coming after cessation of all fever—the icteric tinge after death, all added to the *commemmorative circumstances*, do not admit of a doubt, in my mind, that Clarke died of yellow fever.

"In conformity with your prescription, all the streets between and including Claiborne, Roman, Customhouse, and St. Louis Streets, have been sprinkled with carbolic acid diluted in water; the sidewalks, yards, and gutters of these streets receiving the same treatment. The privies of every house within the above described limits were also disinfected, the odor of carbolic acid being still quite strong in that locality up to 6 P. M. yesterday, the 3d inst. Respectfully, A. C. LANDRY, M. D.,

"*Sanitary Inspector, Second District.*"

Elliott sickened after his arrival, and was attended by a private physician at his boarding-house, corner of Front and Girod Streets, until the evening before his death, without apparently a suspicion on the part of any one that he had yellow fever. Late in the evening of May 29 he was removed to Hotel Dieu, where he died within a few hours. A careful *post mortem* examination was made by two competent physicians, and the body was subsequently inspected by myself. No one of us three doubted the nature of the disease.

We append here the special report of Drs. Schlater and Watkins, giving particulars in the case of Thomas Elliott, late engineer of steamship *Emily B. Souder.*

"Thomas Elliott, white, a native of Ireland, by occupation an engineer, aged thirty-eight years, reached New Orleans, on the steamship *Emily B. Souder*, May 23, 1878. The steamship *Emily B. Souder*, on which Elliott was engineer, plied between this port and Havana. Her last round trip up to May 23, was as follows: She left New Orleans May 11, reached Key West May 14, and Havana May 15; left Havana May 18, reached Key West May 19, arrived at Quarantine station May 22 with a clean bill of health, was detained only long enough for fumigation, and reached the wharf at New Orleans May 23, 1878. While at Havana the captain of the *Souder* was the only one from the ship permitted to go ashore. One case of sickness occurred on board the steamship *Souder* on her return trip, and was diagnosticated 'malarial fever.' Elliott on reaching New Orleans was in good health, and for two days worked unloading the ship. On the evening of the 25th he was taken sick and went to his boarding-house, on the corner of Front and Girod Streets. Dr. F. Loeber saw him on the 26th, 27th, and 28th. On the morning of the 29th he was removed to 'Hotel Dieu.' He was there seen by the house physician, Dr. P. C. Boyer, who found him in a dying condition. Death occurred early on the morning of the 30th. Hearing that a case of 'fever' had been admitted to 'Hotel Dieu' from the steamship *Emily B. Souder*, we visited that institution about 10 A. M., May 30, and found Elliott dead. Through the courtesy of Dr. Boyer we were permitted to inspect the body and make the *post mortem* examination.

"Autopsy. Six hours after death. Body warm. Skin and conjunctiva of a bright canary color. Rigor mortis extreme. Cadaveric hypostases well marked. Stomach congested, distended with gas, and contained about six ounces of semifluid, dark, grumous matter. The mucous membrane of the stomach was congested and softened; very easily removed. The fluid contents were examined microscopically and showed the presence of blood corpuscles. Small intestines congested; contents not examined. Liver of the 'café au lait' color, and gave the appearance of fatty degeneration. Gall bladder contained a drachm of bile. Spleen small and firm. Kidneys congested, and when opened gave unmistakable evidences of recent hemorrhage of their pelves. The bladder contained four ounces of dark-colored urine, highly albuminous. Respectfully submitted.

" M. EDWIN SCHLATER, M. D.,
" *Sanitary Inspector, First District.*
" WM. H. WATKINS, M. D.,
" *Sanitary Inspector, Seventh District.*

" SAMUEL CHOPPIN, M. D.,
" *President Board of Health.*"

Statements of Drs. Samuel Choppin and S. S. Herrick.

" In regard to the case of Elliott, late engineer of the steamship *Emily B. Souder*, we have to say:—

" Notice having been received at the office of the Board of Health that the above named individual had died at the Hotel Dieu, under circumstances justifying the suspicion of yellow fever as cause of death, we repaired to that hospital about 12 M., May 30, to investigate the case. On our arrival we found the body in the dead house, where a *post mortem* examination had already been made. The skin presented a deeply jaundiced hue. The stomach, which had been opened, showed its mucous surface greatly reddened and softened, with appearances of dark, grumous fluid contents. The kidneys had the appearance of severe congestion. The liver was of a light yellowish hue. These are all the usual appearances observed in the examination of a person dead of yellow fever, and we had no doubt that the man had been the subject of this disease.

" SAMUEL CHOPPIN, M. D.,
" *President Board of Health.*
" S. S. HERRICK, M. D.

" NEW ORLEANS, *November* 2, 1878."

Here it is proper to observe that the only case of yellow fever in New Orleans in 1877 came through the quarantine, by practicing deception on the resident physician. This man, a passenger on a British steamer, took passage at Havana, and sickened before arrival at quarantine. However, he was able to go on deck, and passed inspection while sitting with a newspaper in his hand. Fortunately, on reaching the city, he fell into the hands of a physician who promptly reported his case to the Board of Health as yellow fever, and rigorous measures were at once adopted to arrest the infection. No infection survived the rigorous winter of 1876–77; no further harm resulted from the single case of 1877, and it is fair to presume that no trace of the fever existed here previous to May 23.

In 1878 the cases from the *Emily B. Souder* were unknown to the health authorities for a full week after the arrival of the ship at her wharf, at the head of Calliope Street. No further time was lost in making use of the usual means of disinfection around the intersection of Front and Girod Streets, in and around Hotel Dieu, where Elliott died, and in the house on Claiborne Street, where Clarke died. No more cases followed within the period of their apprehended occurrence, and it was supposed the danger was past.

About the middle of July some cases of a strongly suspicious character came to light on Constance Street, near its intersection with Terpsichore, and in a few days all doubt of their true nature was removed. About the 7th of July a young man, named Cohn, came to the Touro Infirmary, from Gasquet Street between Villeré and Marais Streets, presenting strong appearances of yellow fever; but he recovered before attention was drawn to Constance Street, and his case was considered questionable. Within a few days cases were found near the corner of Front and Girod Streets, where Elliott had sickened; on Bienville, near where Clarke had died on Claiborne Street, and a case on Robertson Street, near the home of Cohn, who had been at the Touro Infirmary, not much more than a quarter of a mile from where Clarke died, and a still less distance from Hotel Dieu, where Elliott died.

The line of infection was tolerably clear, though long latent, from Clarke to Cohn, and subsequently to the cases on Bienville and Robertson Streets; also from Elliott, sick at his boarding house, to the subsequent outbreak at the corner of Front and Girod; but the outbreak on Constance Street was so far from the wharf of the *Souder* (fully half a mile), and so long after her arrival (more than six weeks), that it was long considered out of the question to establish a connection between them. Recent investigations show that some of the earliest cases on Constance Street, 122, occurred in the family of a Mr. Caven, who is engineer of the tug-boat *Charlie Wood*. This boat lay at the same wharf occupied by the *Souder*, immediately after the departure of the latter for Havana, as stated by Caven himself to me at the time of his illness.

I desire here to explain the discrepancy between the joint settlement of the Caven family, recently made to Dr. Murray, and the one made by Mr. Caven to me while he was sick in July. In the last statement it is made to appear that the tug *Charlie Wood*, of which he is engineer, did not come near the *Souder*, nor lie at the wharf previously occupied by that steamer; while he had previously declared to me, when the matter was more fresh in his mind, that the *Charlie Wood* took the place of the *Souder* at the head of Calliope Street, on her sailing back to Havana June 1. It should be observed that the last statement of Caven was made in presence of Captain Wood, of the tug *Charlie Wood* (as told me by Dr. Murray, who took it down), and that he started to repeat that the *Wood* lay at the same wharf just left by the *Souder*; but he was checked by Captain Wood, and corrected so as to make a different statement. The explanation is, that the owners and master of the tug-boat were naturally unwilling to have their vessel involved in any responsibility, whether apparent or real, for the introduction of yellow fever that year, and both they and those interested in the *Souder* would have an interest in disproving any connection between the two vessels.

Mrs. Wasson, Caven's mother-in-law, sickened on the 30th of June, with symptoms answering closely to those observed in yellow fever, and two weeks later other members of the family were known to have yellow fever. About the same time several children in a neighboring family, named Bolton, 116 Constance Street, developed the same disease; and it has been ascertained that a colored laundress, Emma Watts, living in the yard of the Bolton family, had done washing for Mrs. Wasson in the Caven yard, and hung up the clothes to dry in the yard of the Bolton family.

It has been ascertained from Mr. Bolton, that his brother John Bolton, lately from Kentucky, died July 16, under the following circumstances. He had been ill for a week, but did not finally take to bed till the morning before his death, and was not attended by a physician. The coroner ascribed his death to congestion of the brain, though it was observed by Dr. Axson, when first called to visit the children, that his body was much jaundiced, as is usually the case with a yellow fever corpse. It has also been ascertained that Bolton was waited on, during his illness, by the same woman, Emma Watts, who had washed clothes in the yard of the Caven family a few days previously. There is, therefore, a probability that John Bolton was a walking case of yellow fever, though this was not suspected until after the infection was introduced to the Bolton premises from the Caven premises, through the instrumentality of the colored laundress, Emma Watts.

It is significant also that a man, named Brady Martin, sickened July 14, at the corner of Bienville and Villere Streets, where he died July 21, under care of Dr. Roudanez, a physician familiar with yellow fever. This man was seen by myself the day before his death, and I quite agreed with Dr. Roudanez in his diagnosis of yellow fever in this case. It is to be noted that Martin's residence is less than three squares from the house where Clark, the purser of the *Emily B. Souder*, had died, May 25.

On July 22 a man died on Robertson Street, between Gasquet and Common, after a short attack of yellow fever. This man's residence was about two squares from that of Cohn, before mentioned, who sickened July 8 and recovered at the Touro Infirmary, and not more than six squares from Hotel Dieu, where Elliott died on the 30th of May.

About the same time occurred several cases near by on adjacent streets, alleged on lay testimony to have been yellow fever; for instance, a child of four years old, at No. 385 Magazine, said to have sickened June 21; a lady at 175 Annunciation Street, taken sick July 2 or 3; besides some others, alleged on rather vague testimony to have fallen sick still earlier, and at localities more remote from the intersection of Terpsichore and Constance Streets. The objection naturally arises that the distance was too great from the intersection of Front and Girod Streets, and the intervals of time too long from Elliott's case to those on Constance Street, for a chain of connection to be established between them. It must be granted that we should naturally expect to find intervening cases, both in space and time; but we are here confronted by no greater mysteries than we find in other infectious diseases.

Outbreaks of scarlet fever take place more unexpectedly and unaccountably than those of yellow fever, yet no scientific physician attributes these to spontaneous origin, nor to local causes. The same disease attacks one or two children in a family, and spares the others ; it seizes individuals at one time after having passed by them repeatedly. It is sometimes sporadic and mild in its visitations, at other times, epidemic and malignant. The same is true, though in a smaller degree, of other infectious diseases. The germ hypothesis in relation to yellow fever will serve to throw light on some of its devious movements and strange behavior. Grant that a certain number of the germs are reproduced, either inside or outside the human body ; that they multiply in rapid geometrical ratio, by repeated generations at short intervals ; that a new generation, brought to life in hot weather, is not only vastly more numerous, but more energetic individually than its predecessors ; that these germs are capable both of spontaneous locomotion along the ground and other surfaces, and of transportation in the clothing of persons ; grant these conditions, which are quite in harmony with the known behavior of animalcular beings, and the difficulty of missing links in the chain of evidence is reduced to mere cavilling. Add to this, the facts that no germs existed from the previous year, to survive the winter in 1877–78, and that there is no suspicion of the introduction of yellow fever this year by other means than that of the *Souder*, and we are reduced to the necessity of fastening the guilt upon that particular vessel; unless we adopt the theory of the spontaneous production of the pestilence from local causes.

The nature of these causes no one can explain, even to his own satisfaction ; nor why they should exist one year rather than another, or should prevail along the coasts of the Gulf of Mexico, rather than the shores of the Indian Ocean. The truth is, any other theory than the germ theory is speedily lost in inexplicable mystery. " As to the germ theory itself," writes Dr. William Budd, " that is a matter on which I have long since made up my mind. From the day when I first began to think of these subjects, I had never a doubt that the specific cause of contagious fevers must be living organisms. Once established in the body, this evil form of life, if you will allow me to call it so, must run its course. Medicine as yet is powerless to arrest its progress, and the great point to be arrived at is to prevent its access to the human body on the sound doctrine of what we can't cure we *must prevent*."

A description of the plan of disinfection practiced by the Board of Health of Louisiana, may here be appropriate. It is based upon the hypothesis that the *materies morbi* of yellow fever consists of living germs, probably animalcular. The object is, to attack these germs, wherever existing, by some agents destructive to low forms of life, without being injurious to their *habitat*. The agents adopted are sulphur fumes for closed apartments, and diluted carbolic acid for out-door localities. Observation shows that yellow fever can be conveyed long distances in a short time, by means of suitable fomites, and by modes of conveyance possessing closed apartments, particularly water-crafts and probably railroad cars. For these sulphur fumigation is applicable, and there is good reason to believe that its thorough use is effectual in destroying yellow fever infection. It is to be observed that all objects which could possibly act as fomites should be freely opened to the influence of the fumes and subjected to the same for many hours. With regard to out-door localities, it is not supposed that the yellow fever infection moves through the atmosphere above the ground, but that it occupies and travels along surfaces at no great distance from the ground. Thus it progresses from an established focus by a spontaneous movement. From repeated observations of the sick with yellow fever, conveyed from an infected locality to a healthy one, without communicating the disease to those around them, and also of persons contracting the disease in an infected locality and subsequently falling sick in a healthy one, without communicating the disease to those around them, it is reasonable to conclude that these germs do not multiply by reproduction within the human body. The supposition is therefore reasonable, that the germs of yellow fever are wingless animalcula.

On this supposition is founded the following mode of disinfection by carbolic acid: Calvert's No. 5 has been selected as the most convenient and economical form, and it is diluted with water to a strength of about three per cent. Wherever a case of yellow fever is discovered, either as an original outbreak (so far as known), or by introduction from some other point, the *locality* is presumed to be infected, rather than the *person*, and a calculation is made of the probable extent of progress of the infection, since its inception from the focus where it was discovered. The area supposed to be infected is then attacked with a three per cent. solution of carbolic acid, by first surrounding it with a belt of surface sprinkled as completely as possible on the streets by squares, covering both roadways and sidewalks. The work is then continued inward to the focus of infection, including the streets and alleys as before, and also private inclosures, yards, areas, etc. Privy vaults within the infected area are disinfected with a stronger solution of carbolic acid, fortified by copperas. In some instances the surface disinfection by means of carbolic acid is repeated within a few days. After the termination of a case of yellow fever, before the disease has assumed epidemic proportions, it is customary to subject the apartment occupied by the patient and all its contents to fumigation by sulphur; but, unless the case should terminate early by death, it is not to be expected that such fumigation would limit the progress of infection.

It is obvious that this plan of out-door disinfection is applicable only to the beginning of the outbreak, before it has attained wide proportions, because the operation is quite expensive and laborious, even on a limited scale. Besides, at the best, there is great uncertainty in its efficacy, even admitting that the germ theory is correct, and that the disinfecting agent is positively destructive to the germs. The uncertainty is due to the fact that we are attacking an invisible foe, sometimes appearing unaccountably, and already occupying an undetermined area, the extent of which must be estimated by a mode of calculation involving several unknown quantities. To these difficulties must be added the impracticability of bringing surface disinfection to anything more than a rather rough approximation of completeness, especially within inclosures occupied by buildings.

Another obstacle to the arrest of the disease by disinfection is the impossibility, with the existing powers of the Board of Health, of preventing peo ple from entering localities presumed to be infected, and carrying away articles liable to convey the infection. It is, therefore, no wonder that, in 1878, an unseen and scarcely suspected enemy should have lurked undiscovered for weeks, until, by multiplication in its successive generations, and by gradually spreading, it had attained proportions too vast for control before its presence was actually recognized.

The opponents of a quarantine system reason chiefly in the interest of foreign commerce, and their calculations must be limited, of course, to commerce with tropical American ports during the six warm months. In its proper place the pecuniary damage of New Orleans through the suspension of this commerce during the warm months will be considered; and we shall now endeavor to count the cost of the past epidemic to our city, on a money basis, following the best authorities on this subject. We premise that almost every branch of industry pursued by our population has felt the paralyzing influence of the scourge. It would be within bounds to say that, for ninety days at least, one half the energies of the acting and working part of the community were diverted from their usual pursuits, either to enforced idleness or to the necessary care for the sick; so that the value of their labor for that time must be reckoned as a total loss. It is also to be noted, that the lives of individuals represent a certain value, as capital to be applied to the production of wealth, quite as justly as do our domestic animals. In this estimate no account is made of depreciation of property and future damage to the commercial property of New Orleans, for they will depend greatly on the means hereafter adopted to prevent the recurrence of a similar visitation.

Cost of the Yellow Fever Epidemic of 1878 to the City of New Orleans.

Estimated number of cases 25,000	
Cost of ten days' sickness of each one, at $3 per day	$750,000
Cost of 4,500 funerals, at $25 each	112,500
About two fifths of 4,500 victims represent each a capital value of $1,000, amounting to	1,800,000
Remaining three fifths, at $300, amount to	810,000
Loss of time of one half the industrial population, say 20,000 people, for ninety days, at $2 per day	3,600,000
Values destroyed by the epidemic	7,072,500
Commercial losses by interruption of intercourse with the surrounding country and diversion of trade to other cities	5,000,000
Total losses	$12,072,500
Estimated profits of the summer trade with ports where yellow fever usually prevails	1,500,000
The difference between these two sums, say	$10,572,500

represents the actual cost of the epidemic to the material resources of New Orleans.

These figures, made upon a basis deemed moderate in all particulars, show that a trade during half the year with certain tropical ports, and worth to our city a million and a half of dollars, is held at a risk of more than twelve millions, the actual losses of 1878, from yellow fever. An estimate of the total losses to our country from this epidemic has been made by Mr. A. B. Farquhar, in a letter to Surgeon-general Woodworth,[1] in which he places it at the enormous sum of $175,000,000.

The experience of the present year with regard to the efficacy of a strict quarantine goes to sustain the theory of importation and portability of yellow fever. Witness Galveston, which has not developed a single case. Witness Shreveport, Monroe, La., Natchez, Miss., with their *shot-gun* quarantines turning away the pestilence, and witness, again, Mobile, which has certainly escaped an epidemic. From the statement and facts given in the accompanying papers, it is an irresistible conclusion that yellow fever is not an indigenous disease of Louisiana, or any other part of the United States, but that in the many years when it has made its appearance in this country it could be traced either directly or remotely to a foreign source. We, in Louisiana, operating under a quarantine law not absolute in its restrictions, after an earnest effort in executing it, conducted with all the honesty and energy at our command, assisted by incorruptible quarantine officials, have utterly failed in preventing the importation of the pestilence, which has thrown gloom and sorrow over our whole southwestern valley. No *conditional* quarantine, gentlemen, can ever be made effective, because, first of the laxity with which laws are unfortunately executed in this country, and, secondly, because of the cupidity of commercial men having large interests at stake, who will always move heaven and earth to evade successfully all quarantine laws and regulations. The great object to be aimed at, gentlemen, is to prevent the germs or fomites of this dreaded pestilence from having access to our people; and the only certain and sure preventive of yellow fever, in my humble opinion, is absolute non-intercourse with ports where yellow fever is indigenous, from the first of April to the first of November of each year. Once eradicate this disease from the land, as it must necessarily be by our cold winters, and, gentlemen, mark my word, we will never again be visited by this terrible scourge, unless introduced from abroad.

[1] Marine Hospital Service.

VII.

REPORT OF THE DELEGATION FROM THE MISSISSIPPI STATE BOARD OF HEALTH TO THE AMERICAN PUBLIC HEALTH ASSOCIATION.

THE State which we have the honor to represent having been one of the chief sufferers from the recent epidemic of yellow fever, it is perhaps proper that we should say something to this meeting. The arduous duties incident to the epidemic left no time for us to collect statistics, and we will, therefore, not attempt to enter into details, but what we have to say will be general and not statistical. On the 2d of August, when only a comparatively small number of cases of yellow fever were officially reported in the city of New Orleans, our towns located on the railroads and on the Mississippi River began to establish quarantines under the direction of the State Board of Health, and a little later the quarantine of entire counties began The first official report received at the office of the State Board of Health of the existence of a number of cases of yellow fever within the limits of the State, was from the town of Grenada on the 12th of August, when fifty cases were reported. Some time before this date, our county Boards of Health had been organized, and soon after the report from Grenada had been telegraphed throughout the State almost every town and village had organized a Board. Very early in the season most of our towns and villages and many entire counties were quarantined. Thus it will be seen our organization to do battle with the pestilence was pretty thorough.

In addition to quarantines, disinfectants (carbolic acid, sulphate of iron, fresh stone lime, etc.) were freely used in the greater part of the State, and an effort was made to place every exposed point in the best possible sanitary condition. When a locality became infected the following measures were resorted to: Households containing patients were quarantined; apartments, after being occupied by patients, were subjected to sulphurous fumigation; bedding, clothing, and towels, used by patients, were burned; the dead were buried soon after death, and carbolic acid was freely used about infected localities.

The abundant experience which we have just had leads us to believe that while disinfectants, cleanliness, good drainage, etc., have their merits in the prevention of some other diseases, they are utterly powerless to prevent yellow fever. Localities that were in the best possible sanitary condition were visited by the disease, which spread rapidly, and was as fatal as in other localities. Seven weeks before the appearance of a single case of the disease, the city of Jackson was placed in the best sanitary condition possible, and, during all of this time, the streets were sprinkled daily with a three per cent. solution of carbolic acid, until the odor pervaded the entire town, but when the disease was introduced an epidemic was the result. The experience of other places was similar. When a place once became infected, the measures resorted to proved utterly futile in arresting its progress. The disease spread in spite of them.

Much has been written on the subject of land quarantines and their impracticability. Our experience has taught us that absolute land quarantines are not impossible, but that they are extremely difficult to maintain, are very inconvenient, and interfere greatly with internal commerce. While many of our towns became infected, still most of them entirely escaped through the efficiency of quarantines, and instances are not wanting where entire counties occupying exposed positions thus escaped. Notably among them is the county of Jefferson, on the Mississippi River, where seventy miles of territory were guarded by mounted police. But while we maintain that land quarantines can be made efficient, and should be established and made rigid when it becomes necessary, still we are anxious to avoid their inconveniences.

Our disastrous experience of this year has demonstrated how difficult, how well-nigh impossible, it is to arrest the development and spread of yellow fever when it has once reached our shores. In addition to our own experience we have the voluntary confession of numerous State and municipal Boards of Health, that their efforts to eradicate the disease by the use of disinfectants have proven wholly ineffectual, if not positively injurious.

Naturally, then, we are led to the consideration of other means by which we may escape future visitations of this death-dealing plague. Satisfied, as we are, by the observance of proofs that we deem indisputable, that yellow fever "does not originate *de novo*," in any *one* of the United States, we are naturally led to consider the means by which its introduction into our country may be prevented. This is a question of the greatest importance to those whose homes are in the Mississippi Valley, and scarcely less important is it to the whole country. The suffering and sorrow and the pecuniary losses that have this year fallen to our portion, and which have so touched and melted the hearts of our whole people, cannot fail to make the prevention of its repetition a subject of profound interest to the whole nation.

The utter failure of such quarantine regulations as have heretofore existed at our Gulf and South Atlantic ports, has sufficiently demonstrated their inadequacy to afford to us that protection which we ask for the safety of our citizens.

While positive non-intercourse with the West India Islands and the Spanish and South American States may not be possible for us to obtain by reason of commercial treaties that may exist between these respective governments and our own, we do ask of our national government that such restrictions be placed upon that intercourse as will prevent the possibility of future visitations of yellow fever. Inasmuch as the States whose ports are thus exposed have proven themselves powerless to successfully quarantine those ports, and, by such failure, have entailed great loss and injury upon the whole nation, we do most earnestly recommend that Congress take such action as will afford to these States the means of making the quarantine of these ports as rigid and effectual as possible.

In conclusion we beg leave to record the profound sense of our indebtedness to the great hearted and sympathizing people of the States outside of the plague-stricken regions for the timely and appropriate relief they have lavished upon us in the gloomy and fearful period of our unexampled calamity.

Respectfully submitted,

WIRT JOHNSTON,
S. D. ROBBINS,
C. K. MARSHALL,
Delegates from Mississippi.

RICHMOND, *November* 21, 1878.

VIII.

YELLOW FEVER AS IT EXISTED IN CHATTANOOGA, TENN., ITS ORIGIN, PROGRESS, AND THE PROBABLE REMEDY FOR ITS ABATEMENT IN THE FUTURE.

READ AT THE ANNUAL MEETING, RICHMOND, VA., NOVEMBER 21, 1878.

By J. H. VANDEMAN, M. D.

Registrar of Vital Statistics, Chattanooga, Tenn.

CHATTANOOGA, the county seat of Hamilton County, Tenn., is situated upon the south bank of the Tennessee River, one hundred and ten miles southwest of Knoxville, three hundred and five miles from Memphis, and one hundred and fifty-one miles south from Nashville, being upon the extreme southern boundary of the State, and nearly midway, east and west, from the State lines; is surrounded by mountains almost upon every side, Lookout Mountain, Waldren's Ridge, Raccoon Mountain, and Minion Ridge encircling the city. It is the centre, so to speak, of a network of railroads, composed of the East Tennessee and Georgia, Western and Atlantic, Nashville and Chattanooga, the Cincinnati Southern, the Alabama Great Southern, and the Memphis and Charleston Railroads, being in daily communication with Nashville, Atlanta, Memphis, Vicksburg, Mobile, and other southern cities; is seven hundred and forty-five feet above tide-water, almost at the foot of Lookout Mountain and Minion Ridge, while the noble old Tennessee rolls its limpid waters almost around the city, in its course to the Gulf. These railroads bring to us daily hundreds of tons of freight and almost thousands of passengers; most of the freight breaking bulk at this point previous to its shipment elsewhere.

With this explanation of our city, brief though it may be, you will see at a glance that she is the great distributing point for the States of Alabama, Georgia, a large portion of Mississippi, and other southern States, and brings back through these railroads their staple products, to again have them distributed through the States north of us. This daily communication from all points south has had its full weight and significance with us this summer and fall, as *you* will see and *we* all have felt.

Our city has a population of over 12,000 inhabitants: 7,500 of them being white, while 4,500 are colored, scattered, of course, over the hills and flats of the city.

The Third and Fourth Wards, as you observe, by glancing at this map,[1] so kindly prepared for me by my friend Dr. Milo Long, are the most densely

[1] Not prepared for publication.

populated, and also contain the largest area of ground that is low and swampy, poorly drained, and with a water supply far from perfect, large portions of both having been filled up the past season with new made earth, while a part of the Third Ward was the receptacle of all the filth and garbage from the sutler stores located there during the late war, and especially that portion of it which lies directly west of Chestnut Street, bounded by Ninth Street on the south and Eighth Street on the north; a small portion of this ward only being upon the hills which divide it.

The Fourth Ward, in a sanitary point of view, is very poorly located, no sewerage, all surface drainage, and that very poor thin soil, the limestone cropping out near the surface, the water supply for both drinking and culinary purposes being derived mostly from shallow wells, in fact, principally *surface water*, percolated through this thin soil; with but a few of her people using either cistern or hydrant water. Most of the above ward is located in the lowest portion of our city, the ground upon its northern boundary gradually rising to considerable of an elevation, where some of our finest residences have been erected, McCardie Avenue being the northern boundary of said ward. In the lower portion of this ward, partly owing to its location, and the carelessness of the people living therein, most of their "vaults" are not over two feet in depth, many of them still less. Some of them are even on top of the ground, yea, even worse, on the surface of the rock, with no facilities for removal of their contents, presenting evidences of prevailing ignorance or criminal neglect of sanitary laws.

Another part of this ward, bounded by Ninth, Eighth, Market, and Cherry Streets, deserves a passing notice. A row of brick buildings fronting one hundred feet on Market Street, and sixty feet in depth, owned by a company of capitalists, and occupied as stores below and dwellings above, having been built during the last year or two on ground below the level of the street (no cellar), with but little if any drainage, is constantly exposed to dampnes of the soil underneath, amounting at times to large collections of water. East of this row of buildings, a distance of about one hundred feet from the same, the lot has been recently filled, some three feet or more, cutting off, of course, all drainage in that quarter; and, to make matters still worse, the superintendent of construction erected some three or more frame privies upon brick pillars, two feet or more from the ground, with shallow vaults, if any, separated by wooden partitions, so that when his vaults are full he would have such an *excellent* plan to waste their contents on ground adjacent; and it is a fact worthy of notice that outside of these models of wisdom, a six foot pole could be easily thrust its entire length into the ground, and still no drainage. Another great disturbing element of a good healthy condition of that ward, existed in the filling up of a street, bordering upon this lot before mentioned some three or four feet, with but little, if any, outlet for the surface drainage from the hills above, and *of course* the lots *above* this street have been since that time very damp, and in fact never have been thoroughly dry.

Let me here speak briefly of the Third Ward, the other portion of the infected district, and particularly of a plat of ground, triangular in shape, bounded by Pine Street on the east, James Street on the south, and a row of buildings fronting on Eighth Street on the north. The base of this triangle is about two hundred feet in length, or a little less, the sides running almost to a point, two hundred and forty feet, or thereabouts, and upon this lot there are some twenty or more tenement houses, or shanties poorly constructed, low ceilings, some neither plastered or ceiled, occupied almost entirely by negroes and poor whites; the entire lot having less than half a dozen privy vaults to supply their wants, and these built almost upon the surface of the ground, never cleaned, while the well from which these people draw their water supply is located in the *centre of the triangle*, with a loamy, thin soil, and of course the same difficulty existing as to drainage as in the ward before mentioned. Another part of this ward lying just south and a little east of this triangle, is lower, more swampy, has nothing but surface drainage, and that very poor; the inhabitants draw their water supply from the well before mentioned, or some wells upon the south side of the block, and in close proximity to the remains of an old livery and sale stable, which had been the centre of all the filth and bad odors in that portion of the city for the past few years and which, fortunately for the health of the place, was burned but a short time since.

The First, Second, and Fifth Wards hardly deserve a passing notice, in a sanitary point of view, being, as they were, comparatively free from the scourge. The first two having easy drainage, greater altitudes, more cleanly in their surroundings, etc., etc., while the Fifth Ward is more sparsely settled, less limestone formation, deeper vaults, better water supply, etc., etc. Pardon me, for thus briefly alluding to the condition of these wards, a description of the same being necessary to a solution of some points connected with the spread of the epidemic in our city.

Here, let me refer you to the mean temperature of our city, daily, for the months of August, September, October, and the first fifteen days of November of this year, so kindly furnished by Dr. Long, who keeps a thrice daily register of the thermometer, rain fall, etc., etc.

Day of Month.	August.	September.	October.	November.
1	81.33	76.66	69.33	38.33
2	82.66	75.66	71.00	44.33
3	76.66	76.66	69.66	49.33
4	78.33	79.66	67.66	48.00
5	79.00	77.33	64.66	51.66
6	80.66	78.33	63.00	56.66
7	81.00	78.00	64.00	66.33
8	82.00	77.33	69.33	55.00
9	82.66	77.66	70.66	50.66
10	84.00	80.00	67.33	49.00
11	80.00	73.33	66.33	59.66
12	75.66	64.33	63.33	50.66
13	75.66	65.33	61.66	50.66
14	77.66	66.00	69.33	50.33
15	80.33	67.33	61.00	-
16	79.00	66.00	60.00	-
17	78.33	69.00	60.33	-
18	81.00	70.33	59.66	-
19	84.66	72.33	59.33	-
20	83.66	72.33	58.66	-
21	79.33	67.33	57.33	-
22	77.66	70.00	58.00	-
23	76.00	64.33	49.66	-
24	80.00	69.66	53.00	-
25	82.00	68.66	54.66	-
26	80.33	72.33	57.66	-
27	82.00	70.00	54.66	-
28	79.33	69.33	44.33	-
29	76.66	71.33	46.33	-
30	74.00	72.33	56.00	-
31	75.00	-	43.33	-

Mean temperature for August = 79.57.
Mean temperature for September = 71.96.
Mean temperature for October = 60.47.
Mean temperature for November = 58.57.

We had local rains on the 11th, 12th, 13th, 14th, 17th, 26th, 27th, 30th, and 31st of August, also on the 4th, 20th, and 23d of September, also on the 6th, 7th, 9th, 10th, 17th, 22d, 17th, and 29th of October. Slight frost appeared upon the night of the 14th of September, while our heavier frosts were during the nights of the 20th, 21st, and 24th of October, frost and ice on the 28th, 30th, and 31st of October, and nearly every night in November up to the present time, November 16.

Our mortality for the last three months is as follows, giving here a list of all the deaths from whatsoever cause: —

Diseases.	August.	September.	October.	November.	Total.
Typhus Fever	–	–	1	–	1
Typhoid Fever	–	1	1	–	2
Intermittent Fever	1	–	1	–	2
Remittent Fever	–	6	–	–	6
Pernicious Fever	–	6	1	1	8
Congestive Fever	–	–	1	–	1
Yellow Fever	1	32	100	7	140
Inanition	–	–	1	1	2
Intemperance	–	–	1	–	1
Dysentery	–	2	1	1	4
Diarrhœa	1	–	–	–	1
Total from Zymotic Diseases					168
Scrofula	–	1	1	1	3
Consumption	2	2	4	–	8
Tubercular Meningitis	–	–	1	–	1
Convulsions (Infantile)	2	–	3	1	6
Dropsy	–	–	2	1	3
Heart Disease	2	1	3	–	6
Pulmonary Gangrene	1	–	–	–	1
Meningitis	2	–	–	1	3
Pneumonia	–	1	–	–	1
Jaundice	–	1	–	–	1
Scorbutis	–	1	–	–	1
Hepatitis	–	1	–	–	1
Abscess	–	1	–	–	1
Railroad Accident	–	1	–	–	1
Drowned	–	1	–	–	1
Paralysis	–	1	–	–	1
Premature Birth	2	1	–	–	3
Poison (Accidental)	1	–	–	–	1
Unknown	2	4	3	2	11

Total number of deaths from all causes	220
Total number of deaths from zymotic diseases	168
Total number of deaths from yellow fever alone	140
Proportion of yellow fever deaths to deaths *from all causes*, from August 1, to November 15, 1878	63.63

Yellow Fever Deaths.

White (males)	62
White (females)	45
Colored (males)	21
Colored (females)	12
Over sixteen years (white)	91
Over sixteen years (colored)	26
Under sixteen years (white)	16
Under sixteen years (colored)	7
Total (white)	107
Total (colored)	33
Total deaths (yellow fever)	140

August 14, 1878, Mrs. Jeanette Swartzenburg, a lady from Memphis, fled to this place, and became an inmate of the family of Rev. Jacob Bach, and on the 17th she fell sick, and died the 21st, four days subsequent to her attack, the case being diagnosed by the attending physician the day previous to her death as "yellow fever," and the certificate of death was furnished accordingly to this office. Her body was hastily buried, the clothing and bedding burned in the back yard, the room fumigated and ventilated, and no serious results occurred to the family of Mr. Bach, no one having contracted the disease. Our next case was also a refugee from Memphis, a Mr. William Griffin, who was taken sick on the 3d of September, was diagnosticated on the 6th as having yellow fever, and died on the night of the 6th; was removed at ten P. M. to the cemetery, and remained above ground until twelve M., the 7th, when he was buried. His clothing and bedding were also burned, room ventilated and fumigated, and no one of the family where he was boarding (and it was a large boarding-house in the heart of the city) contracted the disease, nearly every one of the family and boarders hourly visiting him during his illness, nor was any future case traced to this.

September 1 I was called to see the son of one Vincent Burge, an English boy fourteen years of age, who had come home from his work, in a distant part of the town from where he lived, complaining of chilliness, and quite unwell; went to bed, suffering with headache, and soon with high fever. Next day his little brother Arthur, six years of age, was taken sick, and he, too, was sent to his crib. They were very similarly attacked, and at once put under treatment. There was perfect *intermission* in the former, and unmistakable *remission* in the latter; constipated condition of bowels in both, brown fur on tongue of each, neither pointed nor red, no suffusion of eyelids, no yellowness of skin or eyes in either, pulse not over 110; temperature 98° in one, 100° in the other; but little soreness of the limbs or back; no suppression of urine in either; nor was there *any* vomiting of anything but pure bilious matter, — nothing like black vomit. The next day, September 3, the mother was very similarly affected. The same treatment was adopted for her — alteratives, with cathartics, quinine in large doses during the intermission or remission. The first case recovered completely; the youngest boy Arthur died during the night of the 3d, and the mother the morning of the 7th, with no black vomit in any one of the three cases. My diagnosis was malignant remittent fever, or pernicious fever, in the last two patients, and intermittent fever in the first. There were several other cases during that week of precisely a similar nature, one family, where there were five sick at one time, all recovering. These two deaths, following so closely that of Mrs. Swartzenburg and of Mr. Griffin (the two Memphis cases reported as yellow fever), the latter taking place the same night of the death of Mrs. Burge, created considerable excitement, and our local Board of Health was called together the following morning, with an invitation to all the resident physicians to be present and take part in their proceedings. A full history of these three cases, diagnosis, treatment, etc., etc., was given by myself, the attending physician, and after several queries had been answered by me in regard to the cases, they unanimously coincided with the diagnosis made, made it a matter of record upon the books of the Board, and the same was published in the morning paper of our city as the opinion of not only the Board of Health but of the entire faculty of the city, and the cases are so recorded in the books of the Registrar of Vital Statistics, never having been changed to this day.

The house in which this Burge family lived is located upon the extreme south end of the square which lies south of the block where the first "refugee" from Memphis died, and just across the street from the lot and brick buildings before mentioned, and fifty feet from the east line of said lot, five hundred and thirty feet from the home where Mrs. Swartzenburg took the fever, and died, and about the same distance east from the house where the second case died. Several other cases living contiguous to this lot, and at the same time almost (within forty-eight hours), contracted similar diseases, died, were diagnosed as remittent yellow fever of a malignant nature, and the same has not been changed to this day, while several others recovered completely, having precisely the same symptoms. This Burge family had no direct or indirect connection with either of the two Memphis cases, did not know either the parties themselves, or the families where they died, never did any washing for either, had no clothing from them, and fortunately the parties are living to-day to corroborate my assertion; Mrs. Burge being a woman of feeble health and unable to do her own washing, much less that for others.

Some days previous to the attack of this family the attending physicians reported to this office a couple of cases of yellow fever out in the suburbs of the city, in the Fifth Ward, the patients being two negro boys, who had both arrived from Memphis about the 20th of August, both of whom recovered, and from whom no one contracted the disease, unless it was a member of the Stanfield family, who fell sick and died some three or four weeks later.

Our first citizen case was that of Mrs. L. H. Corey, who was taken down about the 13th of September and died the 19th of the same month. Mrs. Corey was one of our most respectable and useful citizens, living some four squares from the first "refugee" case, and three or more squares from the second, but immediately in rear of and adjoining the triangular space of ground heretofore mentioned. Both the child and husband of Mrs. Corey were attacked at about the same time, and with similar symptoms, having had no connection whatever, direct or otherwise, holding no communication in the least, with either of the cases above referred to, or the cases of remittent fever whose histories are given on the preceding page. The infant son of Mrs. Corey died on the 15th, the mother on the 19th, the first registered as pernicious fever, but afterwards changed to the same as the mother, viz., yellow fever; and though some of our people nursed this family all the time (never having had yellow fever), the coffin of the child being carried to the church, remaining there several hours and services held there, the physician in charge remaining at the bedsides of the patients, almost constantly for days, yet, not a single case of yellow fever can be traced to the Corey family, no one having contracted the disease from that source.

During the progress of the disease in this family and some two or three days previous to the death of Mrs. C., another meeting of the Board of Health was held, with all the physicians again invited to be present, and with the report of a committee of five before them, who had been appointed to visit all "suspicious" cases. They unanimously decided that there were no cases of yellow fever in the city, unless it was that of Mrs. Corey, and her case was considered doubtful. This also was made a matter of record and published in our morning papers. The next day, however, a "woman of the town" died very suddenly, within a few hours of the visit of the city physician, whose duty it was to visit all paupers when sick. This case, from only one visit, was diagnosed as yellow fever. The patient lived but a short distance from Mrs. Corey and south of the triangular lot before referred to, and at the time of her death, and months previous, had had "other diseases" peculiar to her class. The same night her companion, Frank Recter, a one armed ex-soldier, another pauper like the last, was taken suddenly ill, removed to the City Hospital, diagnosed as bilious fever, and died in twenty-four hours from his first attack, and the certificate of death was signed as for "yellow fever." From this date, September 18, the disease spread rapidly, pretty near all over the Third and Fourth Wards, and especially in the immediate neighborhoods of the triangular lot in the Third Ward, and the lot in the Fourth Ward described previously, reaching its acme upon the 11th of October, when there were reported thirty-one cases, and on the 13th of the same month the greatest number of deaths were recorded, viz., thirteen cases of remittent and pernicious fever were reported daily, and some of our Faculty are now of the opinion that we have had no cases of yellow fever in our city this season, a statement I certainly cannot coincide with, though I am firmly of the belief that about the 15th of September we had had no cases of yellow fever, *per se*, except in the cases of the refugees, above referred to. About this time, however, our numerous cases of remittent fever, which were all over the city, appeared to be complicated with symptoms that but few of our physicians were acquainted with, putting on an entirely different type, and about the 28th of September our "local Board of Health," declared the disease epidemic in the wards above mentioned, and advised their depopulation, which, to a certain extent, was complied with, most of the better class of their citizens leaving, a few remaining, while the negroes and poorer class of whites remained. In these two wards was our greatest mortality and number of cases, — the Third and Fourth Wards losing, out of a total death list of one hundred and forty, more than two thirds of the entire number.

The greatest number of cases of yellow fever occurred among the colored race, while the mortality was the largest among the whites. The exact proportion attacked to the number of people left in the city, could only be conjectured, as no census of our city was taken at the time that the least number was left in it. As to the number of cases on hand, and the deaths occurring, we have the best of evidence, an ordinance of our city requiring every case of infectious or contagious disease, as well as a certificate of death from the attending physician, to be furnished the office of the Registrar, which was strictly carried out, and the whole number of cases of yellow fever, as so reported, up to November 16, 1878, was four hundred and forty-six, and the total number of deaths one hundred and forty, making a fraction over thirty-one per cent. of those attacked who died. A table is herewith appended, showing date of first case of refugee and citizens, first death among both, etc., etc., together with the number attacked and number of deaths each week, which was telegraphed weekly to Dr. J. M. Woodworth, Surgeon-general, U. S. M. H. S., at his special request.

Date of First Attack, Refugee.	Date of First Death, Refugee.	Date of First Case among the Citizens.	Date of First Death among the Citizens.	Week ending.	New Cases.	Deaths.	Total Cases at end of each Week.	Total Deaths at end of each Week.
August 17, 1878.	August 21, 1878.	September 13, 1878.	September 19, 1878.	Aug. 21	1	1	-	1
				Aug. 27	-	-	-	1
				Sept. 27	40	21	41	22
				Oct. 4	47	19	88	41
				Oct. 11	144	22	232	63
				Oct. 18	99	33	331	96
				Oct. 25	74	21	405	117
				Nov. 1	30	12	435	129
				Nov. 8	9	4	444	133
				Nov. 15	2	2	446	135

To this list of deaths may be added five more whose certificates have been handed in since, making a total of one hundred and forty deaths, as reported from yellow fever, during its visitation to our city. These tables are as accurate as can be made out (without taking the assertions of non-professional men). As to the number of cases and deaths, — they are official from the records of the Registrar's office, giving the number each day at four P. M.; the reports of new cases and deaths of yellow fever being furnished daily to the office of the Medical Director, where, for the sake of convenience, I requested all reports to be made, and by that office certified to, to me, the original certificates being on file to verify my statements.

Now, pardon me for making a few statements as to the disease itself, its location, spread, etc., etc., in our city. Our first case of fever (among the citizens) of a malignant nature occurred, as before mentioned, September 1, 1878, and not until the 18th did I consider it as anything more than a malignant remittent fever, or pernicious fever, if you so desire to call it, and the cases mentioned were so considered at the time, and so published as the official action of the "Board of Health." My candid opinion is that this was a disease originating in our midst from a foul and contaminated condition of the city, its lack of sewerage, deficient water supply, foul privies, filthy back yards, in a word, from a shameful neglect of the sanitary precautions necessary to the health and well being of any city; this fact being well proven from its first inception, the locality where the disease originated, its progress and termination. At this time, however, it assumed a different type: the tongue changed in appearance, pointed, eyes suffused, temperature high, 103° to 107°, variable pulse, and, as the disease progressed, suppressed urine, discoloration of skin and eyes, vomiting of black matter, — coffee grounds in appearance at first, and towards the last small specks of blood, disintegrated, sticking to the vessel, — bleeding at the gums and nose, increased menstrual flow, the countenance wearing a troubled look, frequent sighing, pains in head, back, and limbs all through the course of the disease, great tenderness upon pressure over epigastric region, tracing the same even up to the mouth and fauces. With all or most of these symptoms the prognosis was unfavorable, and especially so with the whites; the negroes, in the greater number of cases, getting well unless medicated too much. From three to seven days told the tale with most of our patients, though during convalescence great care was necessary in nursing and nourishment, the least exertion or indiscretion in taking food bringing on a relapse, which more often proved fatal than otherwise. The treatment was varied, mild cathartics at first; mustard foot bath; steam bath for the body; few tonics, but, when given, in large doses, diaphoretics, turpentine internally and externally; few anodynes, nitre, acet. potassa, free use of teas, orange leaves, uva ursi, boneset, watermelon seeds, etc., etc., in fact anything that would produce relaxation, diaphoresis, and avoid suppression of urine. The bodies of nearly all our cases were buried at once, hardly getting cold. None were allowed to be retained at home but a very short time; the clothing and bedding were burned.

New cases increased upon us so rapidly that our prospects for a speedy wiping out of the scourge were rather poor. Our public works were stopped, and suffering among the working classes was seen by most of us. Negroes refused to work in a few days more, for the magic word "rations" was soon bruited among them; the like was never before seen in our city, except by those who had lived here in days of the "Freedman Bureau." Something must be done, and that, too, speedily, and the idea first advanced by a few, but not then carried out, was suggested, that of carrying *every one infected* at once to the hospitals, at this time but little used.

People from the infected wards were removed, especially the children, to a camp beyond the city limits, and but a few days had passed before everything looked more promising for a speedy crushing out of the scourge.

We had an organization second to none in our State, composed of representative men from each ward, familiar with the locality and every person in their respective wards, who saw that everything was carried out *strictly* as ordered and directed by the local Board of Health, by whose suggestion a medical staff was organized, composed of a medical director and a volunteer corps of physicians, composed (most of them) of our best young physicians who stepped to the front and did valuable service, two of whom laid down their lives in giving succor and life to suffering humanity, — Drs.

Barr and Baird, all honor to their memory. Two others contracted the disease in their heroic efforts to save others, but recovered. Atlanta, our sister city, also stepped forward, sent us three physicians, opened a hospital, equipped it with furniture and nurses, paid all the expenses, and when the fever commenced to abate turned it over to our General Relief Committee. To the whole North are we also indebted, for their unmistakeable charity, their kind sympathies, their substantial aid, and their daily heroic efforts to relieve our suffering and afflicted South.

Disinfectants throughout the city, along her streets, alleys, and back yards, have done with us but little good, though car load after car load of supplies have been used in these infected districts. Carbolic acid, coal tar, turpentine, sulphur, etc., etc., all seemed to have met the same fate, though used freely all over the wards named. Nothing appeared to give us any relief, nothing to stay the insatiate monster, until the strong arm of omnipotence was stretched forth; the welcome frost was spread all over the land, and the work was done, and at the time of writing this (November 16) but few cases are in the city, most of these are convalescing rapidly, and our refugees are returning home and living in the infected districts.

Now where did it come from? What the cause? How increased in malignancy and virulency? Was it complicated and with what? Or is it a disease *sui generis*, or not? Is it born and propagated in our midst, or increased in malignancy by our own filth and want of sanitary precautions during the past winter and summer? All these are grave questions, and we are called upon this day, to answer them for these people who have suffered so intensely during the past few months.

First, its origin. For a solution of this question let New Orleans answer, for no one doubts that being the focus from whence the whole Mississippi Valley became infected, it being carried from there along the course of our great rivers, and our numerous railroads, to every southern port and town, almost, until it was traced even to our own mountain home, bringing death and desolation in its fearful track.

What the cause? We answer candidly we do not know, but we do know, however, that with us it commenced its ravages in the lowest and most filthy of our wards, raging in great malignancy and virulency in the place before mentioned. The more filth, the more yellow fever; the lower the ground, the poorer the drainage and water supply, there you would find this disease the worst; and, with few exceptions, following in its course the track of the cholera of 1873, having but few cases anywhere else than in the Third and Fourth Wards, except with persons who transacted their daily business there, contracted the disease while there, were removed to their homes in other portions of the city, either recovered or died, and from them no other person contracted the disease after their removal.

Was it increased in virulence and malignancy in consequence of local causes? Undoubtedly it was, and the number attacked and who died in the neighborhood of the place referred to (the Third and Fourth Wards) bear me out in my assertions. It was not the yellow fever of old, but nearly every case was more or less complicated with malarial trouble, being more fatal in the same proportion as their systems were filled with the malarial poison from these infected points, increased in malignancy from our own filth and an absolute want of sanitary precautions during the past twelve months. Complicated? Yes. How could it be otherwise, when we take into consideration the diseases which were raging previous to its arrival here, the utter want of drainage, lack of sufficient water supply, the filth of back yards, and privies uncleaned for years, etc., etc.?

Is it a disease of our own, born and propagated here with us? We answer, No; we believe it to be of foreign origin, reaching us from infected ports in what way you will, by "persons" or "things," yet still a "thing" of importation, its germs carried daily in their system by the refugees, until it reaches a point where the soil, moisture, and heat, together with peculiar and fitting unhealthy condition, in a sanitary view, seems to invite it, to call into play the scattering of these germs, which take root, so to speak, and at once the "destroyer" is at your very door, and you have, not the "yellow fever" of days past, but complicated with malaria, and carrying its death-dealing blows, even to those who are daily administering to the wants of the suffering.

Does fright increase the tendency to attack? We have no doubt of it, but not to such an extent as in the cholera epidemic of days past.

What is the public remedy? I do not mean what medicine shall we give, for too much of this has killed as many as the fever itself; but what can we do to prevent the disease from coming amongst us in our inland towns and our high elevations. We answer, increase the sewerage of our city; build the sewers long and large, make them of some moment, carry their outlets into the streams below our water supply, and far out into our rivers; increase our surface drainage; remove our night soil; enlarge our water supply; fill up our wells (for in cities nearly all of them are daily sowing the seeds of disease); use no water except cistern or hydrant. Lay down strict sanitary rules for the government of our city; enforce them. Use water and money freely, to such an extent as to carry out the above views, and my word for it, our city will never more feel the blighting effects of this terrible scourge.

But what of other cities and towns, where such dire havoc has been made the past season, and especially our seaport towns, where the "germs" of this disease are first planted. We answer, establish a strict national quarantine all along our coast. Examine every vessel that comes to our shores (especially from infected ports), and have this work done by those who are competent, not by parties who are subject to the will and caprices of the commercial public, but have them appointed by the government, fitted for their positions by strict and honest competitive examination, and holding them only during good behavior; men who will attend to the duties which devolve upon them, without fear or favor, especially paying no attention to the bribery of those who are more interested in the sale of their cargoes than the health or welfare of the cities where they desire to land. Let our national Congress enact a law, similar in its nature to the "New York Quarantine Law," appoint competent officers to enforce it from Maine to California, and it will be many a year, if ever, before this scourge will again visit our homes, depopulating whole cities and neighborhoods, laying low in the dust whole families, and making a charnel house of so many of our beautiful southern cities.

X.

THE QUARANTINE AT LITTLE ROCK, ARKANSAS, DURING AUGUST, SEPTEMBER, AND OCTOBER, 1878, AGAINST THE YELLOW FEVER EPIDEMIC IN MEMPHIS AND THE MISSISSIPPI VALLEY.

By R. G. JENNINGS, M. D.,
Of Little Rock.

PRESENTED AT THE ANNUAL MEETING IN RICHMOND, VA., NOVEMBER 21, 1878.

It is well known that only a very limited period intervened, after yellow fever first appeared in the city of New Orleans, before it extended northward up the Mississippi Valley through the great public thoroughfares of travel.

Upon the first report of the fever in New Orleans, the College of Physicians and Surgeons of Little Rock addressed a communication to the City Council, urging upon that body the necessity of appointing a Board of Health. Accordingly, August 3, the City Council appointed Drs. A. L. Breysacher, J. H. Southall, J. H. Lenow, J. H. Dibrell, Jr., and R. G. Jennings, members of a Board of Health. This Board organized August 6, by the election of Dr. A. L. Breysacher, President, and Dr. J. H. Dibrell, Jr., Secretary. The Board quarantined this day against New Orleans.

August 13, Memphis reports one case of yellow fever, August 14, two deaths and nine new cases. The Little Rock Board of Health quarantines this day against Memphis and all other infected places. The train on the Memphis and Little Rock Railroad was ordered not to transport any passengers from Memphis to Little Rock. The railroad officials did not obey this order, and the train, the next morning, August 15, was stopped at Galloways' station, some ten miles northeast of Little Rock, and one hundred and thirty odd passengers on this train quarantined twenty-one days. This railroad was now practically closed, as neither passenger nor freight trains were permitted to run from this date regularly over this road until the quarantine was raised.

In order that the operation and practical results of the Little Rock quarantine may be fully understood, it is necessary to here state that Arkansas has never established a State Board of Health. Accordingly, after the quarantine at Little Rock, almost every city and incorporated town in the State along general routes of public travel followed her example, appointed Boards of Health, and established independent quarantine regulations, adopting whatever local sanitary measures were deemed essential, and imposing whatever restrictions were thought advisable.

By an act of our Legislature, the quarantine limits of the city of Little Rock only extended five miles. This limit, however, was not adhered to by the Little Rock Board of Health, as it was apparent at the commencement, that unless the great highways of communication were controlled at the entrance into the State all local restrictions would only afford the city a very limited protection.

The city of Little Rock is situated upon the south bank of the Arkansas River, about the centre of the State. It has direct communication with Memphis by rail, a distance of one hundred and thirty-five miles. Also with St. Louis by rail, with a branch line extending from Poplar Bluff on the St. Louis road to Cairo, and connecting at Charleston with the Columbus and Memphis road.

The Arkansas, White, and St. Francis rivers are navigable from their confluence with the Mississippi River to points connecting with one or both of these railroads.

Accordingly, upon the report of two deaths from yellow fever in Memphis, as already stated, the Memphis and Little Rock Railroad was at once quarantined, and all communication with the infected city of Memphis and the Mississippi Valley ceased. All steamboats on the Arkansas River were also rigidly quarantined, with those of both the White and St. Francis rivers.

At the same time all connection with Memphis *via* the Poplar Bluff and Cairo line was severed, and health officers placed upon the St. Louis, I., M., and Southern road with instructions to prevent any one from coming to Little Rock, or entering the State, who came from the infected district, without being quarantined twenty-one days. Even with these precautions, it was found that persons occasionally penetrated the quarantine through various stratagems not easily detected, and to prevent this a health officer was stationed at St. Louis, where, with the coöperation of the officials of the St. Louis, I., M., and Southern Railroad, no person or persons could purchase tickets to come into Arkansas who could not give satisfactory evidence that they had not been exposed to yellow fever, or who had passed through places where this disease was known to prevail within the space of twenty-one days.

In order to enforce properly these restrictions, a system of health passes was introduced (which forcibly reminded every one of war times), and no person who could not produce a health-certificate from some official who was duly authorized by a Board of Health to issue and sign the same, was permitted under any circumstances to get on the cars unless he could satisfy the health officer that he could not in any way convey, through himself or otherwise, any infection of yellow fever.

All freight, express packages, and mails from any infected district were likewise prohibited, and refused entrance into our city and State.

In the course of a few weeks the supply of provisions, medicines, ice, disinfectants, and other essential articles in towns along the Memphis railroad, and on the rivers, which had never been abundant, and the extraordinary demand for which could not have been anticipated, owing to the sudden stopping of trains and boats became exhausted.

Occasionally supply trains and boats were granted permission, under the supervision of a health officer, appointed by the Board of Health, to transport such necessary supplies, but not to bring back any passengers except in very few instances, and then only persons well known to the local Boards of Health, which had been established in every town along the lines, and which coöperated, in every particular, with the Little Rock Board of Health. By means of their coöperative assistance every event or circumstance prejudicial to the public health, or in any manner liable to disseminate yellow fever, was known at once, and counteracted by prompt executive action. Thus, in only a few instances was our quarantine circumvented, and as these parties were punished, or fined to the utmost limit of the law, scarcely any one desired to make attempts in this direction, and consequently every requirement of the Board became rigidly enforced.

Skiffs plying between the north and south banks of the Arkansas River were restricted to two landings, to certain hours, and for some time were tied up altogether. A voluntary patrol of citizens guarded every avenue, or approach to the city, night and day, and no one could enter who was not known, or who failed to produce evidence that he had not been within the yellow fever district.

It is hardly deemed of sufficient interest in this paper to enter into the details of the enforcement of sanitary measures within the city of Little Rock; suffice it to say, that every possible means known, possessing any practical virtue as a prophylactic agent in the purifying and disinfecting of the city, was thoroughly tested, and everything done that was possible under the circumstances with the limited funds at their command. All classes of citizens manifested a deep interest in everything connected with the action of the Board of Health; and many of those who could, generously contributed direct monetary assistance towards promptly executing its instructions.

The coöperative assistance rendered by local Boards of Health throughout the State was of immense advantage to the Little Rock Board, making a concert of action equivalent to a State Board of Health. Some of the local Boards of Health established regular *shot-gun* quarantines, yet they served every purpose, and of course enforced all their regulations. The quarantines south and east of Little Rock were of very decided benefit, and afforded ample protection from these directions.

The yellow fever did invade some portions of Arkansas. Hopefield, opposite Memphis, had a great many cases, but as the country was a vast swamp for miles around this place, and not inhabited, only a few sporadic cases extended into the country beyond. The disease was also transported to Helena, on the Mississippi River; the person came from Memphis, and died there with it. The sheriff of the county was reported as having had it. Then the disease remained dormant for some weeks, when it was reported to have sprung into existence again, but was soon checked entirely by the timely intervention of frost.

Several suspicious cases, pronounced yellow fever, occurred at Augusta on White River. It was reported to have been conveyed there from the yellow-fever steamboat quarantine near St. Louis. Some five or six persons were said to have died with it. It, however, never extended into the country, and was cut short by the frost.

An instance occurred which is thought worthy of being here narrated. Four colored ministers, three of them from the southern portion of the State, and one from Little Rock, passed through Memphis, August 3, to attend a religious convention at Jackson, Tenn. They remained there some ten days or two weeks, when, having obtained certificates of health from the Board of Health at that place, on their return they made their way towards St. Louis, shunning infected places. They state that when they arrived at Humbolt, they had to wait the greater proportion of the night in order to obtain a train upon which they could travel at a limited expense. Knowing no one there, and seeing a box car open, half full of rice in sacks direct from New Orleans, they concluded to enter this car and sleep a while. Two of them lay down upon the rice-sacks and the other two upon the floor of the car. All four returned *via* St. Louis to Little Rock, remained here one day, when three of them returned to their homes in the southern portion of the State. The Rev. Dick Samuels, one of the two who slept upon the rice-sacks, resided in Washington, Hempstead County. He had been at home only four or five days when he was taken down with yellow fever. He was immediately "shot-gun" quarantined by the Washington Board of Health, and died some nine or eleven days afterwards. The quarantine prevented any propagation of the fever.

The Rev. James Reed of this city, the moment it was telegraphed that Samuels had the fever, was searched for, but could not be found. Some time after this it became known to this Board of Health that Reed, feeling the symptoms of yellow fever coming on, took his little family and moved some five miles from town on the south side of Fouche Mountain, into an isolated cabin, where he had the yellow fever and died with it. As the excitement against violators of the quarantine was running very high at that time in Little Rock, it is evident that Reed thought he would avoid trouble by quarantining himself until all danger was passed. He was the other one of the two who slept upon the rice-sacks, and his removal from the city possibly prevented propagation of the disease in Little Rock.

It is certainly singular, that only the two who slept upon the rice-sacks had the yellow fever, and particularly so, as they themselves had considerable discussion upon this subject prior to lying down, the two who slept upon the floor contending that there was danger in sleeping upon the rice-sacks, while the two who did sleep upon them did not believe that yellow fever could be contracted by such means. These facts were related by Samuels previous to his death, and corroborated by the two now living.

During the yellow fever prevalence there seemed to be a singular tendency to hemorrhages and fluxes, noticed by quite a number of medical gentlemen in various sections of the State. In malarial fever the black vomit was observed in some instances. Remittent fever was frequently attended with congestion, and easily relapsed, creating the impression with some physicians, that the influence of the epidemic was felt all over the State. As a matter of history, it may not be improper to state that in 1853 three persons were put off from a New Orleans steamboat at this place with yellow fever. The disease was never communicated to any of the citizens.

In 1873, when the epidemic desolated Shreveport and Memphis, several persons from both places came to Little Rock and died with the fever. There were fourteen deaths from yellow fever in that season on this and the north side of the Arkansas River, which included a few citizens, among them a physician who was then acting as health officer; but the lateness of the season, and an early frost, prevented any great extension of the disease. In 1873 a quarantine was established in Little Rock. The restrictions were few, and these loosely and imperfectly enforced. It bore no comparison to the quarantine of this year. The Little Rock quarantine was raised on the 28th of October.

The maintenance of an inland quarantine has been generally regarded as a difficult matter. In fact, some eminent physicians and scientists express grave doubts of the utility of such a quarantine, and believe that nothing beneficial has been accomplished by this means in preventing yellow fever from extending and spreading in any direction in which favoring winds could convey the germ of the disease. It matters little what diversity of opinion exists upon this point; one thing is morally certain, the majority of the people believe, and the public press also claims, that the quarantine established by the Board of Health of the city of Little Rock not only saved the city, but the State, from the ravages of this virulent epidemic.

XI.

ON THE GEOGRAPHICAL ELEMENT IN THE ETIOLOGY OF YELLOW FEVER, AND ITS BEARING UPON PREVENTION.

By HENRY HARTSHORNE, M. D.,
Of Philadelphia, Pa.

PRESENTED AT THE ANNUAL MEETING, RICHMOND, VA., NOVEMBER 22, 1878.

THERE are two groups of diseases, by common consent ascribed to morbid poisons, which have some features common to them all, yet presenting an important distinction in the fact that the causation of the one group is geographical, and that of the other personal. In accordance with these two kinds of causation, measures of prevention ought to be respectively adopted. Unquestioned examples of the two groups are: of personal causation, small-pox; of geographical, malarial (intermittent, remittent) fever. Isolation and personal protection (by vaccination) are reasonably suggested and resorted to for the former; no one thinks of such measures against the latter.

To which group does yellow fever belong? With the great majority of physicians and others who have given the subject attention, no difficulty would exist in answering this question categorically, but for the facts which have, in a number of instances, connected cases of yellow fever, at or near a port of entry, with the arrival and presence of ships coming from localities where the fever existed.

Such facts obviously might be (before exact investigation) conceived as related to the conveyance of the morbid poison either by the vessel or cargo, or by the persons on board. When the former is established, it accords altogether with the reference of yellow fever to local or geographical causation; a ship being a moving fragment of a place, so far as concerns the essential difference between things and persons as vehicles of the poison-cause.

It may be asserted, then, and the assent of the American Public Health Association is especially asked to the proposition, that

Yellow fever is a disease the conditions of whose origination and extension are geographical or local, not personal.

No attempt will now be made to argue in detail in regard to the very few instances in which it has been alleged that new cases of yellow fever have occurred in localities more or less remote from those in which the disease was epidemic, in coincidence with the arrival of persons or clothing from those infected places. Public hygiene needs to dwell upon, and be guided by, broad, well-ascertained, general facts. A second proposition, then, may be brought forward, the denial of which, with authenticated proofs, may be safely challenged, namely: —

No epidemic of yellow fever, resulting in so many as a score of deaths, has ever been shown to occur, remote from water communication, in consequence of the arrival of persons or personal baggage, or merchandise (not of a putrescible kind), from a place infected with yellow fever.

More generally we may describe the geographical etiology of yellow fever as follows: it is, and has always been, confined to the Atlantic Ocean and its tributary inland seas (Gulf of Mexico and Mediterranean) and their shores, and the vicinity of the rivers that empty into the Atlantic and its connected seas and gulfs. The only asserted exception to this fact is, the occurrence, in one or two doubtful instances, of a few cases in immediate connection with vessels sailing to the Pacific coast of South America, around Cape Horn, from the West Indies.

To illustrate this proposition. No case of yellow fever was ever heard of at Tokio, Canton, Cairo in Egypt, Vienna, Berlin, or San Francisco. If the latter city may, by a not quite impossible accident, have (as there is no reason to suppose has been the fact) had an instance or instances of it, at least we may boldly assert that there never was, nor will be, an epidemic of yellow fever in any of the cities named, or in any of such situation, *remote from the Atlantic basin, its seas, gulfs, and rivers.* Another undoubted fact concerning yellow fever, is its relation to season and local temperature. At this very time the civilized world is rejoicing in sympathy with the afflicted South at the intelligence sent over the wires that frost has extinguished the morbid cause for this year, and exiled citizens may return in safety to their homes. This characteristic is antipodal to all that we know of personally *contagious* diseases. While extreme reduction of temperature may suspend the activity of their poison-cause, the effect of the ordinary conditions of the winter season in communities is to concentrate their contagion within warmed habitations, so that such diseases are more prevalent during the colder than during the warmer months of the year.

As a conclusion from the facts and general considerations above set forth, and from a broad survey of the evidence upon the subject already familiar to physicians and sanitarians, the following final propositions are offered: —

Whereas, *sporadic* cases of yellow fever having been known to occur in many places from year to year, without causing a mortality so great as to demand exceptional attention, the pressing demand upon sanitary science at the present moment is to determine principles whereby widely destructive *epidemics* of the disease may be prevented; or, when occurring, checked, and their ravages arrested; and,

Whereas, the causation of epidemics of yellow fever is clearly involved in conditions which are geographical or local, not personal, — no *epidemic* of the disease ever having been shown to have resulted from *personal contact* in the absence of the required local conditions, — it is to be concluded: —

That all restrictions at quarantine should be applied to *vessels* and *cargoes* coming from infected ports, and *not to persons; i. e.*, that personal quarantine against yellow fever, by sea or on land, is unjustified by science, and shown by experience to be totally ineffective; while it inflicts immeasurable evils upon many innocent persons, as well as upon commerce; and,

That the measures of prevention of yellow fever, which the present state of sanitary science especially commends to public confidence, are of two kinds: 1, vigilant and enlightened sanitary police applied with constancy both to cities and to ships, in, or coming from, the regions known to be liable to the disease; 2, prompt removal, by municipal authority aiding private efforts, of all the population of a locality known to be infected, to a place or places distant therefrom, whose conditions may be kept in salubrity.

Should the judgment of the American Public Health Association favor the affirmation of these propositions, their declaration might simplify the ground of the inquiry, and promote the removal of an undesirable confusion upon the subject in the minds of many persons at the present time. It would appear to be within the legitimate sphere of labor of such an association, not only to acquire and diffuse knowledge of the best methods of combating diseases, but, also, as far as possible, to minimize their injurious effects upon commerce, and upon all the interests of humanity.

XII.

THE EPIDEMIC OF 1839.

By G. W. AUSTIN, M. D.,
Of New Orleans.

READ AT THE ANNUAL MEETING, RICHMOND, VA., NOVEMBER 20, 1878.

THE cause of yellow fever, like all zymotic diseases, is unknown, and instead of taxing our brains to find out what it is, we will find it more profitable to study its habitat, its habits, its infectious and contagious character, its portability, and last of all how to prevent its repeated occurrence. By the law of exclusion only can we hope to prevent its introduction into our country, as well as its migratory habits after it is introduced. We have to acknowledge the *Insect* hypothesis, as advocated by Lionel Beal and others. Dr. J. C. Nott, of Mobile, whose long experience and close investigations in yellow fever entitle his opinions to great respect says, "The only hypothesis which in our present state of knowledge has any plausible support, and which may assist in directing our future researches, is that which supposes the agency of some minute insect or other organic form, animal or vegetable, possessing the powers of self-propagation and locomotion, and which, from its deliberate mode of progression, in spite of calms or winds, from all points of the compass, would seem *to travel upon the ground*, where it will be found by the microscopist, if ever detected." He suggested that an infected vessel would be the best place for microscopic investigations, as we are certain of its presence here in an intense form, from the fact that the disease is rapidly taken by all who visit such vessels. It is killed, like insects and hot-house plants, by a temperature of 32° Fahrenheit. It cannot live where the banana is killed down by the cold of winter; hence it hibernates in the mild winters of the South, — as it did in 1873, 1874, and 1875, in New Orleans, having been brought there the previous year by the ship *Valparaiso*, which lay at the foot of Second Street, Fourth District.[1]

In thirty-five years' practice and observation in New Orleans, Louisiana, and Mississippi, I am satisfied that the disease has never in a single instance originated there. It is indigenous to the climate of the West India Islands, the coast of Mexico and South America, within the tropics, and not in the United States. It is conveyed here by ships in fomites, owing entirely to our unrestricted intercourse with the West Indies and other intertropical ports. It has been communicated to us precisely as we have during the present year communicated it from New Orleans to towns and villages by rail and boats, until it has spread all over the country, on passengers with their goods or baggage. When it has reached the air of a

[1] See Report of Dr. C. B. White, then president of the Board of Health.

cold climate, the germs have failed and become harmless, for one of two reasons: that the germ has lost its force, or there is not an adaptation of the atmosphere calculated to absorb and propagate the poison. It was carried from New Orleans in 1873 to Shreveport and Memphis, and other towns and portions of country, just as it has been brought to New Orleans this and previous years. It is not *endemic* in any of the Southern States. I refer to a collection of facts published in 1853, in the New Orleans "Bulletin," by I. G.

These facts are reliable, for they are furnished by careful observers; the writings of such men as Dr. J. W. Monette, of Washington, Mississippi, published in 1842, Dr. W. M. Carpenter, of New Orleans, published in 1844, and Dr. J. C. Nott, of Mobile, in 1842 and 1843. When the ports of the Southwest shall hereafter be guarded, as they assuredly will be, from the approach of this (yellow fever) as well as other contagious maladies of foreign origin, by appropriate sanitary restrictions on our internal commerce, and when the result will prove the correctness of the opinions put forth and so ably sustained by these gentlemen, that yellow fever does not originate in New Orleans, that it is always imported hither, and that it is eminently transmissible, the credit will justly attach to their memory, and their claims to a grateful recollection will be fully acknowledged by generations yet unborn. These opinions of Dr. Carpenter, given more than thirty years ago, are fully sustained by hundreds of our yellow fever physicians throughout the Southwest.

"Dr. Rush," remarks Monette, "is the great father of the doctrine of local origin of yellow fever from putrescent matters and city filth. The doctrine taught by Dr. Rush on this subject, enforced and promulgated as it was by his popularity and talent, has doubtless been the destruction of thousands. Had it not been for his influence in the medical community of the United States, our Northern seaports would not have been so long subjected to the pestilential visitations of yellow fever. New York, Philadelphia, Baltimore, and Boston, and other ports of less note, would have protected their citizens by judicious quarantine at least twenty years sooner than they did. The Southern ports still acknowledging a vassalage to his authority, and to his arbitrary doctrine through his disciples, to this day immolate hundreds of thousands of victims upon the altar of a blind credulity." Dr. Rush himself, before he died, declared that he had always considered yellow fever to be contagious, and that in promulgating contrary opinions, he had yielded to certain considerations.

"Whether," observes Dr. Carpenter, "Dr. Rush regarded the introduction of the disease as unavoidable, and hoped to disarm it of a portion of its terrors when it occurred, or whatsoever may have been the ground of his opinion, certain it is that the opinion thus inculcated has been mainly instrumental in causing for so long a time the neglect of all measures and precautions, and subjecting our cities to the terrible ravages of this worst of plagues."

The experience of Carpenter, Monette, Nott, and others, that have left the stage of life, together with the hundreds of living witnesses (medical men) who have passed through many epidemics of yellow fever, should be conclusive evidence that yellow fever is of foreign origin, and does not originate in the United States.

I am sorry to say that in a late article in one of our popular scientific journals the writer makes the assertion that "yellow fever is indigenous in the Southern States." The writer is just as correct as Dr. Rush was when he said it originated in New York, Philadelphia, and Boston. If the doctrine of local origin in the Southern States be true, why did it make its appearance in Boston, New York, and Philadelphia more than one hundred years before it visited New Orleans? It also visited New Haven and Providence before it appeared for the first time in New Orleans. It was in 1796 that it made its first appearance inside of the mouth of the Mississippi River, and reached New Orleans. At that period it had been three times in Boston, seven times in New York, and nine times in Philadelphia. In 1702 it was brought to the eastern shore of Biloxi Bay, and broke out in old Fort Bayou, among the French settlements. The first governor died and the settlers moved away to escape this imported scourge. This French settlement is eighty-four miles from New Orleans on the N. O. & M. Railroad, and now known as Ocean Springs. How absurd that it originated where ice will form, as it frequently does form, in our Gulf States. It is a well-known fact that in 1804 the Rock of Gibraltar, with an area of four hundred acres, almost all rock, fifteen hundred feet above the sea, a city inaccessible, lost one third of her entire population with yellow fever. Does any sane man suppose that it originated there?

This yellow fever germ is transported in ships, fomites, and various ways into the Southern States, as it was in Boston, Philadelphia, Baltimore, New Haven, Providence, R. I., and in New York until after the epidemic of 1822, where a rigid quarantine has been kept up ever since. Put a stop to that quarantine in New York, and keep up a lively trade with the tropics in summer, and my word for it we shall see a larger per centage of deaths than we have ever seen in New Orleans from yellow fever. It does very well to say to the Southern people, open your ports and do away with quarantine; that is exactly what we of the South have been doing all our lives. What has been the result? Why, every city, town, and village has quarantined against us. Now I propose that this of 1878 shall be the last epidemic of yellow fever in New Orleans. That we shall declare *non-intercourse* between all the ports where yellow fever is endemic and New Orleans from the first day of May until the first day of November.

Had we done this fifty years ago, New Orleans would have a population more than treble of what she has now. Besides, we would not have to mourn for the thousands of our best citizens that have been swept away in each epidemic. Look on the millions of dollars of trade that New Orleans has lost this year! how will it compare with the profits on the coffee and fruit trade. Why, I would agree to drink no more coffee, and eat no more tropical fruits, rather than run the risk of another epidemic of yellow fever.

Who, in this convention, will raise the question of commerce where the lives of the whole population of the valley of the Mississippi are at stake? This *non-intercourse* is my plan of quarantine; adopt it, and commerce will increase with ports that now quarantine against us. The yellow fever germ was brought to New Orleans by the steamship *Emily B. Souder*, as reported by Dr. Choppin, president of the Board of Health. My first case was Mr. Charles M. Moore, who contracted the fever from a focus on Phillip Street, where there was a death from black vomit. A few days after leaving this residence, the yellow fever focus, he came to the upper City Hotel, where there had been no fever, was stricken down with yellow fever, — his attack was a severe one, he had black vomit, — and recovered. This patient was seen with me by Dr. Joseph Holt, sanitary inspector of the Fourth District. This epidemic of 1878 is in every respect like the epidemic of 1839, which was widespread and terrible in its effects, and constitutes a memorable epoch in the history of this malady. Its rise and progress, to the close of its fatal career, were carefully observed and noted by Dr. Monette. As this epidemic of 1839 was so much like the epidemic of 1878, it is one of the few instances that have come to our knowledge, where the subject of yellow fever, considered in connection with one of the most remarkable visitations of the disease that ever occurred, attracted the close attention it deserves, and the result is conclusive in proving the transmissibility of the malady. Yellow fever never has prevailed epidemically at the same time in so many seaports and inland trading towns of the United States, as it did in the summer of 1839. Scarcely one of these seaports having commercial intercourse with the infected ports of the West Indies, or of Mexico, escaped the fever, and almost every inland town having direct and unrestricted commerce with these seaports, after they became infected, became infected also. The first appearance of the disease was invariably in the seaports among the shipping, especially those from infected West India or Mexican ports. In every instance the disease existed for weeks among the shipping before it spread among the inhabitants. In no port in the United States was a case seen until after it had been prevailing for some time in the West India and Mexican ports.

At Charleston, S. C., on the 7th of June, three cases of fever were reported to be on board the brig *Burmah*, just arrived from Havana. Two of these cases died the next day. On the 10th other cases were reported on board of other vessels. On the 12th the *Briganza* arrived from Havana, with several yellow fever cases on board. On 1st July (other vessels with fever on board having arrived in the mean time) the sickness spread rapidly among the shipping. About 10th July the disease began to extend among the people near the wharves; and in ten days after it prevailed over the city. As soon as the fever became epidemic in Charleston all the inhabitants who could leave the city immediately fled, and for the most part to Augusta, where yellow fever never had existed before. During the latter part of July a few of these fugitives died of the fever at Augusta, and on the 20th of August the disease had become epidemic there. I will ask my friend from Charleston, will he hesitate to advocate non-intercourse with all these facts staring him in the face, or will he, like we of New Orleans, wait until he has further experience? Some fifteen or twenty days before the appearance of the fever at Augusta, and as long a period after it appeared epidemically at Charleston, the disease made its appearance at Savannah, as vessels from the West Indies, as well as fugitives from Charleston, had arrived at Savannah before the fever broke out there. It is uncertain to which of these causes it was ascribed; but one thing is certain beyond a doubt, that it was imported, that it was infectious, and, I think, contagious.

About this time an infected vessel from Havana arrived at Portland, Me., after losing several of her crew on the voyage; several deaths by yellow fever soon after occurred in that place, of persons belonging there, who had been on board this vessel while at the Portland wharf.

The disease made its appearance at Mobile this year among the shipping, simultaneously with the same disease in New Orleans. In both places the first cases were among the shipping. It continued to spread until the 20th of October, when it began to abate. On the 1st of November the disease was considered extinct. This summer of 1839 was like the past summer in New Orleans, unusually hot, dry, and calm. Up to the time when the fever began to increase, the population of the city, resident and transient, never were more healthy at any season of the year. But by the 15th of August these prospects were blasted, and at the instance of the authorities the unacclimated, to the number of some thousands, immediately left the city and spread themselves over the country, and in the towns and villages within three hundred or four hundred miles of New Orleans.

This same course was pursued by our citizens this year, with the exception that this year they left earlier and returned later — those that lived to return. The extension of the epidemic of 1878 to the towns on the Mississippi River, the Lake shore, and the interior of Louisiana and Mississippi, was carried by the Jackson and Mobile railroads, and by steamboats plying on the river. In the epidemic of 1839 we had no railroads, and it was carried exclusively by boats.

PENSACOLA. — The first case appeared at the Navy Yard. The patient was from New Orleans, and died with black vomit on the 5th of September. The next cases were members of the family where he was sick. Several doctors who visited him died.

DONALDSONVILLE was the next place to suffer. Several persons returned from New Orleans, sickened and died from black vomit. Twelve or fifteen of the inhabitants of the place died of yellow fever.

BATON ROUGE escaped for the reason that she refused to allow the steamboats from New Orleans to land. The following towns lost many of their citizens by intercourse with New Orleans: Port Hudson, Waterloo, Bayou Sara, Fort Adams, Natchez, Vicksburg. This city had never been visited by yellow fever until the year 1839. The mortality from the disease was fearful; it continued its ravages until checked by frost, during which time about fifty persons fell victims to it. The other places visited by the disease suffered severely; namely, Grand Gulf, Alexandria, Thibodauxville, Franklin, New Iberia, St. Martinsville, and Opelousas. Nothing can resist the authority of facts, which appear to support the conclusion that *yellow fever is of foreign origin, highly infectious and contagious, and must be kept out of the country.*

XIII.

IS EFFICIENT QUARANTINE POSSIBLE OR PRACTICABLE?

By D. C. HOLLIDAY, M. D.,
Of New Orleans, La.

READ AT THE ANNUAL MEETING, RICHMOND, VA., NOVEMBER 21, 1878.

It is not appropriate here to speak of the pathology or treatment of yellow fever; exhaustive monographs on these subjects abound in all languages and in every country. The facts we wish to elucidate in connection with this epidemic are: —

1. Its origin, its mode of extension, and rapid propagation over so large and varied a geographical area.

2. Can quarantine be *positively* relied upon for its future banishment from our country?

I think if we could satisfactorily answer the last question in the affirmative, all others would be virtually disposed of, and need give no further uneasiness.

Of the difficulties of establishing a perfect or effective quarantine, I think the able report of the Commission is a most convincing proof. Here we have three gentlemen, all working separately, but to the same end — that of finding out the truth of the mode and ways by which yellow fever was propagated throughout the country. Notwithstanding the really short time they had to work in, the many difficulties they were forced to overcome, and the multiple sources of error which they were obliged to avoid, still what a marvelous result! They did not fail to find, in a single instance, a clear and satisfactory mode of introduction, and an uninterrupted chain of communication between the infected places, whether by person or fomites, and the various places examined.

In some places, although the proofs are reported as convincing to themselves, others might fail to discover any real connection between the facts and results, and even it might suggest itself to some inquiring minds, that the proofs were somewhat forced, to arrive at conclusions wished for.

Let me here, once for all, in any criticisms I may make of the various reports you have received, disclaim doing so in any spirit of malevolence, but merely to have both sides discussed. All up to this time has been to prove the truth of the importation theory alone, both for its introduction into New Orleans and its spread elsewhere. Let us briefly review the testimony proving the introduction of the two first cases of yellow fever into New Orleans. Apart from the usual difficulties always attendant upon fixing the precise date and locality of the first cases in any epidemic, there were peculiar difficulties here.

Clarke, the first case mentioned, was the purser of the *Emily B. Souder*, which vessel arrived at New Orleans on the 23d day of May. Clarke was taken by his physician from the boat to his room; died there the second day after his arrival, attended the whole time by a physician, an old practitioner in New Orleans, and who ought to know yellow fever. His certificate was, that he died of congestive malarial, or something to that effect.

Elliott, the engineer of the same boat, worked two days after his arrival, increasing the probable time of leaving an infected port to eight or nine days. When taken sick he went to his hotel, sent for a physician, was retained there two or three days, and sent to hospital for more careful nursing (so his physician informed me), he considering the case simple malarial diarrhœa. The day after his arrival in hospital he died. Now were either of these cases certainly yellow fever? Clarke was said to have died of yellow fever from some remarks of the ignorant attendants who nursed him, notwithstanding the physician's certificate to the contrary. Elliott's case was elucidated by a post mortem examination, and we all know how extremely difficult it is to positively affirm the existence of yellow fever when only a post mortem examination is shown us.

But admit, for sake of argument, that both these cases were yellow fever. How can we possibly explain an interval of full two months before we hear anything more of the fever. Again, after that lapse of time how difficult to obtain any really satisfactory chain of connection between those and the subsequent cases. This is well illustrated by the manifest contradictions in the testimony of one of the witnesses, first to the Board of Health, and second to the Yellow Fever Commission at a subsequent examination. Has quarantine so far, in any instance, ever prevented the introduction of yellow fever as an epidemic? I think the unanimous reply would be in the negative. Because in some places where quarantine is enforced no epidemic yellow fever occurs, is no evidence that this immunity comes from the quarantine.

We have the testimony of many careful observers to prove that with or without quarantine the visitations of yellow fever occur equally often. We know, too, that before the epidemic of 1853, the shores of the Mississippi above and below New Orleans were always spared, the favorite watering places along the shores of Lake Pontchartrain also; but how different since.

This year the advocates of quarantine cited in triumph Natchez, Shreveport, Mobile, and Galveston, as instances of the protection vouchsafed by quarantine. *Per contra*, we know that epidemic yellow fever has prevailed in each and all of these places and not in New Orleans.

I have just learned of a singular instance of exemption without any quarantine or attempt at it during the year, — Huntsville, Ala., a place of about five thousand inhabitants, where no yellow fever has occurred. Notwithstanding the introduction of over twenty or thirty cases, and their receiving whole families of refugees, with furniture, bedding, etc., etc.

My informant gives as his reason in explanation of this paradox, the fact that in 1873 Huntsville was the seat of epidemic cholera. After the disappearance of this pestilence, a conference of the health officers was called, and an improved system of drainage at their instigation was adopted, and a general improvement in hygienic measures inaugurated, which are still adhered to.

In conclusion, let me say that after carefully reviewing all the facts I do not believe efficient quarantine, in our present state of knowledge, possible or practicable; and therefore the substitution of sanitary and hygienic measures for quarantine, isolation, and restriction, would afford more certain and effectual protection.

XIV.

MEMORANDUM CONCERNING THE REFUGEE CASES OF YELLOW FEVER IN PHILADELPHIA, 1878.

FOUR cases of yellow fever occurred in Philadelphia during the recent epidemic, — all refugees.

On the morning of the 24th of August, the Bonelli family, consisting of seven adults and one infant, arrived in this city from Vicksburg. They were in apparently good health on leaving home, and passed the Cincinnati quarantine without difficulty. Soon after their arrival here, two of the family — young men aged fifteen and nineteen years — sickened with yellow fever. As soon as these cases were made known to the Board of Health, the entire family of eight persons, with all their effects, were removed to the Municipal Hospital.

The disease was confined to these two cases, both of whom recovered. The third case, Morris Bernheiser, was one of a party of three refugees from Holly Springs, taken sick after reaching Philadelphia. He was removed to the Municipal Hospital, together with three members of his family, residing in the city, with whom he had been in contact during the commencement of his sickness. This case recovered. The fourth case, a gentleman by the name of Pate, from Water Valley, Miss., sickened at one of our hotels, where he remained under treatment for three or four days before the character of the disease was fully known.

As soon as it was discovered, he was removed to the University Hospital, where he died within twenty-four hours after his admission. There was no black vomit in this case, but very great discoloration of the skin, and suppression of urine.

The healthy companions and relations of the sick with whom personal intercourse had been had during the disease, were all quarantined in one wing of the hospital for a period of ten days, while all clothing was thoroughly cleaned and disinfected. No disease developed in the city from these cases.

Very respectfully, your obedient servant,

J. HOWARD TAYLOR,
Medical Inspector Board of Health.

TO ELISHA HARRIS, M. D., President American Public Health Association.

XV.

REPORT ON THE YELLOW FEVER IN NASHVILLE, TENN., SEPTEMBER AND OCTOBER, 1878.

BY J. BERRIAN LINDSLEY, M. D.,
Of Nashville, Tenn.

READ AT THE ANNUAL MEETING, RICHMOND, VA., NOVEMBER 21, 1878.

DURING the first week in August several cases of yellow fever occurring in Memphis attracted the attention of the Board of Health, composed of four physicians and the mayor. The sanitary condition of the city was then pretty fair, comparing favorably with that of most American cities. The Board met in called session on August 8, and basing its action on the report of the Health Officer, determined to place the city and suburbs in PERFECT sanitary order, and to use every precaution against the introduction and spread of the disease, save that all persons from the region desolated by the epidemic were to be freely welcomed to the city as a refuge and haven, which exposed us to imminent danger.

Accordingly a large force was employed as scavengers, and all manner of filth safely movable was speedily got rid of. Lime, copperas, and coal tar were used *ad libitum* for disinfecting or deodorizing every foul spot which could not otherwise be remedied, whether that spot was a sluggish branch, incurable privy vault, hog pen, or what not. Stink, that infallible index of impure air and of unworthy officials, was for the time being abolished. The ugliest alley became a not unpleasant highway.

By September 1 the city and suburbs became full of refugees, the old war-time term being a significant and popular word. Every hotel and boarding-house was crowded, and hundreds of families were doubled by friends and relatives from West Tennessee. The daily press and the hourly bulletin board kept all apprised of the steady march and relentless ravages of the plague. Familiar and honored names were frequent in the lists of the dead, thus bringing the dreaded pestilence near to every heart. For once in the history of Tennessee political feeling and excitement was absolutely extinguished, though on the eve of a general State election. The alarm among our people was great. It became intense when Chattanooga, the mountain girded city on the south, was stricken as by a thunder clap, and when Bowling Green and Louisville to the north were threatened and penetrated by the steady moving poison. Yet there was not one hour of panic or one instance of stampede. For the confidence of the people was absolute in the honesty of the Board as well as in its faithful sanitary work.

Along with sanitation, isolation was a precaution practiced with successful vigilance. The entire medical profession of the city acting in perfect harmony with the Board, brought every real or supposed imported case at once to its knowledge. These were promptly removed to an excellent infirmary on a high hill two miles from Nashville, where every possible attention, medical or otherwise, was furnished.

Several citizens employed on railroads at Hickman, or elsewhere, who contracted the fever and got well or died at home, were as closely watched and isolated as if they had been removed to the infirmary.

In all cases infected bedding, clothing, etc., etc., was destroyed by fire. The rooms occupied were disinfected by sulphurous acid, and aired for weeks, or until frost, before reoccupation. Carbolic acid was freely sprinkled upon bedding and clothing, but no great reliance was placed upon its efficacy, except as a panic soother.

All along, the grand disinfectants relied upon were fresh, pure air, and the direct rays of the sun. And the common people were so taught.

From early in August all sleeping cars from infected points, and all through trains, were prohibited. Products and goods were not brought from the infected points. The railroad authorities voluntarily coöperated in these precautions, and in the inspection of all trains entering the city as perfectly as though compelled to do so by rigid law.

The first case was reported on Saturday, August 31. It was from Memphis, and located in the most filthy region outside and adjoining the city limits. The infirmary not being quite ready the patient remained here until convalescent, when he was removed to the infirmary, and finally recovered. His brother-in-law, also from Memphis, was taken after he had been in Nashville two weeks; a most violent case, died at the infirmary. The last death occurred on October 16, an employee of the Louisville Railroad Company, who had not been out of Nashville. He had received friends into his house from Memphis, and it would seem had been very careless as to their baggage.

In all, between these dates, there were about twenty cases and thirteen deaths. Of the latter, five were in the houses of citizens, the remainder at the infirmary. The spring was unusual in the rainfall. July was hotter than usual. The mortality in Nashville (spring, summer, and autumn) less than in 1875, 1876, 1877, the only years in which a mortuary record has been kept.

The city and suburbs, under jurisdiction of the Board of Health, contain by accurate census a hundred or two beyond thirty-seven thousand people.

Under similar circumstances I would venture a similar experiment,— open our doors to all, and then vigilantly use every precaution, having the city previously in good sanitary condition.

XVI.

HISTORY OF THE EPIDEMIC IN BALTIMORE IN 1876.

BY JOHN MORRIS, M. D.

THE generally accepted theory that yellow fever has its origin in local causes, and that it is personally non-contagious, has met with marked confirmation in the history of the localized epidemic of this disease, which prevailed in Baltimore in the autumn of 1876. The locality in which the epidemic referred to was developed was very similar in its sanitary condition to that of Key West in 1875, so well described by Dr. Robert D. Murray, in his report to the supervising surgeon-general. The same filthy accumulations, the same want of drainage, the same character of houses and surroundings, obtained in both places, as will be shown hereafter by comparison.

The seat of the outbreak of yellow fever in Baltimore in the autumn of 1876 is a small peninsula, bounded on one side by Lancaster Street and on the other three sides by the water. On this peninsula, between two and three hundred people were huddled together in small tenements, all the surroundings being of the most noisome character. The yards and contiguous lots were filled with the accumulations of years; privies had not been emptied of their contents, but were covered over by a superficial layer of clay; and the whole condition of things was most deplorable, and such as to invite an eruption of disease at any moment. The history of this epidemic is briefly as follows: —

The first case of death was reported, by Dr. Winternitz, on the 14th of September, 1876. This was followed by forty-four cases of the disease, of which forty died. Then the authorities, thoroughly alarmed, had all the people living in the infected quarter, sick and well, numbering in all one hundred and fifty persons, removed to the Quarantine Hospital, some miles from the city. A cordon was placed around the locality; the whole place was purified; nearly a hundred cart loads of filthy accumulations were removed; the privies were emptied and filled up with clay; the homes and clothing of the people were cleansed and disinfected, and a certain portion of the latter destroyed, and every possible source of infection was removed. The result of these measures was that not a single case of the disease occurred afterwards, and the whole trouble disappeared as if by the power of a magician's wand. Though one hundred and fifty persons were removed to the Marine Hospital, and twenty-five cases were treated there, fifteen of which proved fatal, not a single one of those engaged in removing the sick — nurses, physicians, etc. — contracted the disease. Only one single death took place at a distance from the infected district, and that was a patient who had lived in one of the houses in which there had been several cases, and who died twenty-four hours after leaving it. This portion of the city, before the year 1855, was visited frequently by a sporadic form of yellow fever, recognized by the physicians practicing on Fell's Point as genuine yellow fever. Will, Block, Philpot Streets, and that portion of Canton Avenue contiguous to these streets, were the principal points in which the poison vented its force. The Board of Health of the year 1855, having at its head Dr. Kemp, early in the spring of that year, warned by the experience of former years, examined the whole locality, and wisely adopted such precautionary measures as would prevent the presence, or at least the accumulation, of such substances as are known to favor the growth of the peculiar miasm which renders fevers of the type spoken of so malignant in character. Lots which had been the receptacles of filth and water for years before, were drained, and, in some instances, filled up. A change was also made in the construction of the wharves at the Back Basin. The consequence of these measures was that neither during the year 1855, nor since that time until 1876, was there the slightest sign or menace of an epidemic. The enlightened course pursued by this same Board of Health in regard to the quarantine regulations during that year ought not to be forgotten; but this is not the place to dwell on the subject. Though there was free intercourse permitted between Norfolk and Portsmouth, and more than forty cases of the disease occurred among the fugitives, including thirteen deaths, not a single citizen of Baltimore was attacked during the year.

The non-contagiousness of this virulent disease was most strikingly exemplified by the results at the Quarantine Hospital. Dr. E. Lloyd Howard, the quarantine officer, in his report of that year says:—

"In connection with the late epidemic, it is a subject of much significance, that, while the disease appeared to be rapidly spreading in the locality where it originated, as soon as the sick, with their families, were removed to this place and put under better hygienic conditions, all its contagious or infectious features, if it had any, at once disappeared. I separated, as far as practicable, the sick from the well, but in many cases husbands, wives, and children could not be kept from their sick relatives, and frequently the sick and the well slept side by side. Yet in not a single case did the disease appear to spread. Only two cases of the fever were developed here, and in each, the symptoms appeared within two days after the arrival of the parties at the hospital, so that we have every reason to think that the *disease had no infectious nature* when removed from the filthy surroundings it had in the city, to the well ventilated wards and tents of the hospital. I regard this fact as one of great interest, and pregnant with suggestions as to the treatment of any such epidemic in the future."

In all histories of epidemics of yellow fever it is the usual custom among those who doubt the local cause of the disease to endeavor to establish a theory of the importation of the poison, but in this instance all efforts to this end utterly failed. I have investigated with the utmost care all the facts and circumstances bearing on the subject, and I can find no proof of the importation of the disease. A ship from the Spanish Main, the pilot of which died, was said to be the source of the infection; but this ship had left port more than six weeks before the outbreak. Dr. Bates, who attended the pilot during his illness, has furnished me with the details of his case, which I now subjoin. The doctor says:—

"On Tuesday, August 8, 1876, I was requested by my friend, Dr. Cathell, to see a case with him which presented some peculiar features. Accordingly, at five P. M., I visited with him William Pembroke, æt. 19; occupation, pilot; residence South Washington Street, near Bank. Pembroke had arrived that morning by the Norfolk boat in a stupid condition, unable to give any account of himself, and was put in a hack and sent home by some one who recognized him. The only history we could get was that he left the city in charge of a vessel about a week previous, had been taken sick in the neighborhood of Hampton Roads, been under the care of a physician for several days, and as soon as he was movable had been sent to Baltimore. When I saw him he was lying on the bed held by two men, yelling at the top of his voice. His pulse was weak and slow, face mottled, eyes injected, skin hot, tongue dry and brown, epigastric tenderness, and complete suppression of the urine as was proved by the catheter. He seemed to be tormented by the most intense terror; it required the full strength of two men to hold him on the bed; if the hold was relaxed for a moment he would slip from their grasp, jump out and try to hide himself under the bed, or behind some object. So long as he was struggling he was silent; but as soon as he found he was powerless to escape, his yells could be heard a square off. No answer could be obtained to any suggestion. We wrote a prescription for some medicine and sent for it. While waiting for its arrival, he had one of his violent struggles, which subsided and left him quieter than the previous ones had done. He remained so for a few minutes when he commenced retching; he was turned on his side and threw up about two wineglassfuls of dark, almost black blood, gave a few gasps and twitches, and died. The skin immediately assumed a dark-brown hue. We were puzzled by this case. We agreed that if there was any yellow fever in the city we would call this a case of that disease; but we knew of no yellow fever and knew of no exposure upon his part, as he had not been outside the capes. Subsequently we ascertained that an infected vessel had discharged her cargo on the Point; that he was sent to pilot her out, with instructions on no account to go below; he was taken sick, and compelled to sleep in the cabin; at Fortress Monroe he was sent on shore, where he remained a few days, when he was sent up by the Norfolk boat."

Now, it will be perceived that the date of Pembroke's illness is August 8, five weeks before the first case was reported by Dr. Winternitz to the Health Board. There is also, it must be observed, no history of any communication between the pilot Pembroke, and the people in the infected district; indeed, the supposition must be that no intercourse took place between the parties. Dr. Thomas B. Evans, of Baltimore city, a well-known physician, believes that he treated a case of yellow fever in the early part of

August, at a short distance from the infected district. I give his statement as a portion of all the testimony I could get in regard to the outbreak. Dr. Evans's statement is as follows: —

"The summer of 1876 was remarkable for the intense heat of the sun, and also for the degree of moisture in the atmosphere. The dew point was exceedingly high, and vegetation was in consequence very profuse. There was also a very great increase in diseases of a malarial nature. A large portion of my practice is in the twelfth district of Baltimore County, adjacent to Canton in the eastern section of this city. This section is well watered by several creeks and rivers that empty into the Patapsco River. I treated several cases of malignant bilious fever in this locality, and there were other cases that fell into the hands of others; but all of them presented characteristics that enabled us to note that the malarial poison was very much intensified, and was attributable to favoring conditions of heat, moisture, and profuse vegetation. On the third day of August I was called to see John Whiting, living on Durham Street, between Alicianna and Lancaster Streets. (This locality is four squares east of the fever district, as the lower part of Caroline Street has been called.) He presented such symptoms as a bad case of bilious fever would give. I thought it such until the fourth day of his illness, when the yellow hue of his skin became noticeable, and the vomiting, which had been persistent from the first, assumed the appearance of black vomit. I then began to recognize Yellow Jack, upon whose features I had not gazed since 1854. This man recovered after six weeks' sickness. I think it was about the third week of his illness, when, entering his home one morning, I noticed immediately opposite three crapes, death's banners, waving from the doors of three houses. Inquiry elicited the fact that three persons had died from some cause, after four days of extreme suffering. I crossed over and asked permission to see the dead. It was granted, and on the features of each the yellow hue of the vomito was plainly seen, and all of them had had vomiting of black matter previous to death. This was learned of those who had attended them during their sickness. In a few days there were many cases in that neighborhood; and then followed the outbreak around the back basin and the lower part of Bond, Thames, Philpot, Block, Wills, and Caroline streets. The facts here given will not support the theory that yellow fever is an exotic, but rather that it is indigenous. The locality where these people lived was filthy. They were overcrowded in their homes and uncleanly in their habits. In consequence of the grade of the street (Lancaster) at this point, all the washings of Ann Street, Baltimore, Lombard, Pratt, and other streets, found their way into the basin at the foot of it, distant about one hundred yards from where these persons lived. During a heavy rain the bed of the street was always filled with water and impassable, and about an hour after the rain would cease the water would subside, leaving the bed of the street full of mud and filth. [Since that time a sewer has been built by the city that fully remedies the evil complained of.] This, together with the extreme heat of the summer, the temperature being above 75° [1] in the shade and run-

[1] 75° cannot be called extreme summer temperature. — ED.

ning so for more than six weeks, was sufficient, in my estimation, to cause the disease. In Caroline Street, or the fever district which impinges upon that open cesspool called the Back Basin, were found all the elements necessary to generate yellow fever; and as long as the basin remains as it now is, with all its surroundings intact, you can have yellow fever always after six weeks of hot, wet weather."

It is due to truth to add, that not one of the cases referred to by Dr. Evans in the foregoing statement was reported to the Health Office as yellow fever, and that it was only in the light of after events that they came to be so termed. The pilot's case, too, was reported as a case of "Pernicious Remittent Fever," which no doubt it was. Dr. Winternitz, who reported the first case to the Health Office on September 14, seems to think that he treated a genuine case of yellow fever on the 25th of August. I give his statement in regard to both these cases: —

"August 26th was called to see Mrs. Francis Kimaners. Married, twenty-one years old, a strong, robust woman, residing at 352 South Caroline Street, near the water, next door to a junk shop filled with old ropes and sailcloth bought from all kinds of ships.

"My diagnosis was malarial fever. Next morning patient was very sick, intolerable pain in epigastric region, constant efforts to vomit, etc.; in the afternoon of the same day coffee-ground vomit; died about six o'clock. Did not examine the body post mortem; did not suspect yellow fever, as I had never seen a case, and made up my mind that I was treating a case of malignant malarial fever.

"September 13 was called to see Jos. Pedzinck, a laborer on the coal-wharves, about thirty-six years of age, a strong, robust man, of temperate habits, living at No. 333 South Dallas Street, just in the rear of the house of the former patient. The cause, duration, and symptoms were the same as in the first case. The next morning the man died. The post mortem appearances told me in an instant what I had to deal with. It was, indeed, the most fearful discovery I had ever made in my practice. These were both unmistakable cases of yellow fever. I reported them at once to the Health Office. Dr. Steward, Dr. Evans, Dr. McShane, and Mr. Lurick, who had seen a great many cases of yellow fever, went with me to see the corpse, and it was unanimously declared a case of yellow fever of the most malignant type. This locality remained the centre of the infected district."

It will be evident from the statements here given, and they embrace all the facts bearing on the subject, that no chain of communication can be traced out between the Spanish ship, supposed to be infected, and the locality of the outbreak. More than two months elapsed from the time of the death of the pilot Pembroke to the occurrence of the first case reported to the Board of Health. Even conceding Dr. Winternitz's first case was a true one of yellow fever, which is by no means certain, more than three weeks had transpired after the departure of the suspected vessel. Besides, I can discover no history of intercourse between his patient and the vessel. In the outbreak at Portsmouth and Norfolk, in 1875, I remember distinctly that the first cases were traced directly to the infected ship, and occurred in those engaged in unloading it. In addition to this, I find that only one single case of yellow fever was treated at the Quarantine Hospital from abroad, during this year, and that was received there in July from the brig *Flying Scud.*

HUMAN ORDURE.

To insanitary conditions, then, and most particularly to the presence of human ordure, must be ascribed the origin of the epidemic. There is no doubt in my mind that decomposing human ordure is the most potent force known to men in the production of zymotic disease. The fecal accumulations in the locality described in this paper were no doubt the *fons et origo* of the great malignant trouble that ensued. It is a notable fact that in the cities both in South America and the Southern States of this Union, the same plan, described before, prevails of not emptying, but filling up and covering over, the cesspools. They are thus suffered to remain as beds of poison under the power of the intense heat of a Southern sun. In Rio de Janeiro, where yellow fever is scarcely ever absent, this is particularly the condition of things. A coffee merchant of Baltimore, of great respectability, assures me that he has at times perceived the smell of human ordure in the coffee consigned to him from that port. At the present time an epidemic of malignant dysentery prevails at the Baltimore Almshouse due entirely to this cause. The ordure has been used as a fertilizer on the fields adjoining the institution, and the very vegetables used by the inmates partake of the foul odor. The origin of scarlet fever, typhoid fever, diphtheria, and other zymotic diseases, has been with great reason ascribed to this cause, but in my judgment also the malarial poison which is the great factor in yellow fever is intensified by the presence of animal filth, and particularly by that most objectionable and deadly form of feculence, human ordure. That it was the predominating element among all the poisonous forces existing in the infected peninsula in Baltimore in 1876 I have not the slightest doubt.

From the foregoing facts the following deductions may be drawn: —

1. That a malignant type of yellow fever can originate from insanitary conditions.

2. That even in the most malignant form of the disease the fear of personal contagion need not be entertained.

3. That precautionary sanitary measures are alone needed to prevent an outbreak of the disease; and, further, that an outbreak having occurred, it can be arrested and completely stamped out by a thorough isolation of the locality in which the disease originates, as well as of the people, both sick and well, dwelling at the time in the immediate neighborhood.

4. To secure a thorough exemption from the spread of the disease, a detruction or disinfection of the clothing, furniture, etc., of all persons in the infected district is not only necessary but indispensable.

5. That precautionary measures, such as the filling up of cesspools, drains, vacant lots, etc., and the use of disinfectants, should be commenced early in the year.

6. That these views being entertained, and these suggestions carried out, quarantine regulations need not apply to persons, but solely to ships and their effects.

XVII.

A STUDY OF THE YELLOW FEVER EPIDEMIC OF 1876, AS IT AFFECTED THE STATE OF GEORGIA.

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"Durch den Widerspruch wird der Geist der Prüfung genährt." — *S. Stricker.*

DURING the summer of 1876, the Atlantic coast of the United States was visited by an epidemic of yellow fever which exhibited a malignant type in certain localities that heretofore seemed to enjoy a species of immunity from the disease; while at others, which in former years appeared to be peculiarly favorable for its development, the unhealthy season passed, either with no occurrence of yellow fever, or with so mild a type of the disease that the demonstration could not be dated as an epidemic.[1]

In 1876, the epidemic influence was most violently exerted upon the coast of the State of Georgia. The cities of Savannah and Brunswick, about one hundred miles apart, were almost simultaneously subjected to an epidemic explosion. Doboy Island, the port of the town of Darien, thirty miles north of Brunswick, followed. The Isle of Hope, ten miles southeast of Savannah was attacked; a modified epidemic occurred at the inland cities, and isolated cases occurred at Oliver Station, on the Central Railroad, forty-seven miles from Savannah, and in the city of Atlanta, the latter about three hundred miles from the coast.

As the practical lessons to be derived from the epidemic in question are so strongly marked, it has been thought desirable that a connected narrative of these various outbreaks should be prepared, that the epidemic diffusion may be judged of from a more extended stand-point than that of a single, and therefore isolated locality.

The Georgia epidemic of 1876 furnishes a valuable opportunity for study-

[1] At Charleston, S. C., but twenty-seven deaths occurred from yellow fever in the city; there were two fatal cases on James Island, and several on Sullivan's Island and at Mt. Pleasant. In the city two of the fatal cases were refugees from Savannah. At Mobile, Ala., but two cases occurred; a fatal case from New Orleans; a case which recovered from Savannah; both cases taken sick at the Battle House. At Pensacola, Fla., no cases occurred in the city; but two cases, one of which was fatal, occurred at the quarantine. At Key West, Fla., no cases occurred either in the city or at quarantine. At New Orleans, La., seventy-four cases occurred with thirty-five deaths. At Galveston, Texas, no cases occurred.

During the year it was reported that a serious outbreak of yellow fever had occurred at Baltimore, Md. This is, however, officially reported as an outburst of typhus malarial fever.

ing the natural history of yellow fever. It would be difficult to isolate an extended epidemic, in which the localities involved would present as great a diversity of local conditions as in this instance.

(A.) The city of Savannah, built upon the banks of a swift-flowing river, but surrounded by swamp lands, and possessing many intra-mural causes of disease, has almost unequaled advantages and disadvantages of location. (B.) The city of Brunswick, built upon an arm of the sea, free from swamp lands and other malarial influences, with a small and much scattered population, and no intra-mural causes of disease. (C.) A small island surrounded by salt water, having a population of less than two hundred. (D.) A rural community, which is a summer resort for many of the inhabitants of Savannah. (E.) The inland cities of Augusta and Macon. (F.) A railroad station forty odd miles from Savannah. (G.) The inland city of Atlanta.

But four epidemics of yellow fever have occurred in the city of Savannah They were in the years 1820, 1854, 1858, and 1876. Some few cases are reported as having occurred in other years, but no extended diffusion of the disease took place. Of that which is sometimes called the epidemic of 1827 and 1828, Dr. H. E. Brown[1] writes: "In 1827–28 there were a few cases of black vomit occurring during a general prevalence of *dengue*, but no epidemic of yellow fever." And this is most probably true as to other years in which it is claimed that the disease was present. Neither Brunswick nor Doboy Island were ever infected with yellow fever prior to 1876. Darien, twelve miles distant from Doboy Island, and of which town the island is the port, had the disease in 1854. The Isle of Hope has always been considered as a place of refuge from infectious diseases by the inhabitants of Savannah. Augusta[2] has had but three epidemics; namely, 1839, 1854, and 1876. Macon has had the disease but once before, in 1854. In addition to the localities named, the town of St. Mary's was infected by this disease in 1808. It is, therefore, a matter of interest to determine the cause of the epidemic outbreak, which in a period of twenty days took place in the six indicated localities, the local conditions of which differ from each other in so marked a degree. If the occurrence of an epidemic of yellow fever is only to be accounted for by certain local conditions (meteorological and telluric), it will be found impossible to trace any sameness of cause; but if it is true that the cause of the disease is a specific poison, which may be transported by the migrations of individuals or through the agency of common carriers from one locality to another, and that its development at points otherwise uninfected is governed by certain meteorological and telluric conditions, then a sameness of cause will be apparent.

In the city of Savannah there existed the factors claimed by those who advocate the theory of local origin; but at Brunswick, Doboy, the Isle of Hope, Macon, and Augusta, the same combination of factors is not found. Thus an interesting field of study is at once opened. It is, therefore, proposed to present a narrative of all facts which have been collected during

[1] *Quarantine on the Southern and Gulf Coasts of the U. S.* By Asst. Surg. Harvey E. Brown, U. S. A. New York: William Wood & Co., 1873. p. 31.

[2] *Report of Georgia State Board of Health*, 1876, p. 132.

the past year, that from them a correct theory, as to the causation, may, if possible, be adduced.

The influence of altitude in controlling the development of yellow fever is demonstrated by this Georgia epidemic. Dr. J. M. Toner, of Washington, D. C., has shown that the specific cause of yellow fever has never been propagated at a greater altitude than five hundred feet within the limits of the United States.[1] The accompanying hypsometric map[2] of the State of Georgia fully illustrates the truth of that assertion so far as that State is concerned. Upon the map all localities at which yellow fever has occurred as an epidemic are marked, and the altitudes of the various localities will be found to be within the limit named.

In 1876 the existence of the yellow fever epidemic on the coast of Georgia, was recognized at the following dates:[3] —

Savannah	August 21.
Brunswick	August 21.
Doboy Island	September 5.

The out-break of the epidemic at each of the three ports named was preceded by the arrival of the following named vessels from Havana: —

At Savannah. — The Spanish brig *Iñez;* fifty tons of ballast; eleven in crew; eight days out from Havana; quarantined three days; arrived July 15; cleared with cargo of lumber, July 23. The Spanish bark *Maria;* one hundred and forty tons of ballast; thirteen in crew; five days out from Havana; quarantined three days; arrived July 17; cleared with cargo of lumber, August 2. The Spanish bark *Pepe;* fifty tons of ballast; ten in crew; eleven days out from Havana; quarantined eight days; arrives August 2; cleared with cargo, August 9. The Spanish bark *Maria Carlina;* two hundred tons of ballast; thirteen in crew; nine days out from Havana; quarantined fourteen days; arrived August 16; cleared with cargo of lumber, early in November. The Spanish brig *Profita;* one hundred tons of ballast; thirteen in crew; seven days out from Havana; quarantined ten days; arrived August 18; cleared with cargo of lumber, in November. These vessels discharged their ballast at the Atlantic and Gulf Railroad wharves, with the single exception of the bark *Pepe*, which vessel was discharged at the Central Railroad wharves, on the extreme western side of the city.

At Brunswick. — The Spanish bark *Marietta;* two hundred tons mixed ballast; fourteen in crew; eight days from Havana; no quarantine; arrived August 1; cleared with cargo of lumber, early in September.

At Doboy Island. — The Spanish bark *Valentina:* two hundred tons mixed ballast; thirteen in crew; eleven days from Havana; no quarantine; arrived August 27; cleared with cargo of lumber, September 16.

Of the Spanish vessels which made the port of Savannah, nothing can be learned, which proves positively that they were the agents in the diffusion

[1] *Reports and Papers American Public Health Association*, 1875, i., pp. 359–384.

[2] The several maps accompanying this paper are omitted, as the publishing committee did not feel authorized to incur the extra expense of their publication.

[3] *Report of Georgia State Board of Health*, 1876, pp. 116–120.

of the disease; but the circumstantial evidence is so strong that they did possess such agency, that they cannot be relieved from the suspicion. There was no sickness on either of the vessels which have been named, when they arrived in port, and no deaths had occurred which could not be satisfactorily explained. But it can be shown that in each and every one of these vessels certain factors of the disease were transported. None of these vessels, with the exception of the *Maria Carlina*, became infected while in Savannah. Of the *Maria Carlina*, Dr. George H. Stone, of the United States Marine Hospital Service, states that the captain, three sailors, and two passengers were the only persons belonging to the vessel who were not in hospital with yellow fever after October 9.

At Brunswick the bark *Marietta* was provided with a clean bill of health from Havana. No yellow fever occurred on her during the voyage or after she reached Brunswick, but her captain stated to the Collector of Customs that the disease had been on his vessel while he lay in Havana, and that he was now manned by convalescents from hospitals.[1]

At Doboy Island the bark *Valentina* had no bill of health from Havana. When at Brunswick, August 23, the captain alone went on shore. It is asserted at Doboy that this vessel lost her entire crew from yellow fever in Havana, just before she sailed, and that her present crew were from the hospitals. We have, however, failed to obtained any evidence as to this vessel or any other from Havana. Nothing is known of her, and it is not improbable that she may have had sickness on board when at Doboy Island.[2]

As in all preceding epidemics of yellow fever which have affected the United States, that of 1876 was preceded by an extensive epidemic in the West Indies. In that year the West Indian out-break was confined to the Island of Cuba. Its greatest severity was expended upon the city and harbor of Havana; but some few cases of the disease are reported as having occurred at Matanzas, Cienfuegas, Trinidad, and Santiago de Cuba.

According to the published statements of the Royal Academy of Medical Sciences of Havana, the total number of yellow fever deaths for the three summer months of 1876 was twelve hundred and thirty-five. They were distributed as follows: —

June	291 deaths.
July	685 deaths.
August	259 deaths.

It is, however, known that this epidemic commenced in the month of May, but of the number of cases for that month we are unable to obtain any record.

As the islands of the West Indies are now recognized as the habitat of yellow fever, a full knowledge of the occurrence of yellow fever in an epidemic form upon any of that group of islands is a matter of vital importance to the inhabitants of the Atlantic and Gulf cities of the United States. These islands lie almost at our doors, the trade between the two localities

[1] *Report of Georgia State Board of Health*, 1876, Appendix, pp. 53, 56.

[2] Letter of Consul-general Hall. *Report of Georgia State Board of Health*, 1876, Appendix, p. 31.

is so extensive and so varied in character that unless a full and perfect descriptive list of each individual vessel that may enter American ports could be obtained, out-breaks of the disease will continue to occur, which, from the very obscurity which surrounds the initial cases, will seemingly admit of no other solution than that of the spontaneous generation of the disease at the locality which exhibits the infection.

Our efforts to obtain full facts as to this out-break in Havana have been unsatisfactory, but we are able to present certain interesting generalities, which we owe to the courtesy of Dr. Edward Belôt of Havana.

"The harbor of Havana is surrounded by marshes on the southeast and partly on the north sides. Six small fresh water creeks run into these salt marshes; four on the Regla and Guanabacoa, and two on the Atarés and Charsez sides of the harbor. The harbor also receives all the drainage of the city. In the rainy season the water becomes of a greenish opaque color, and has an offensive smell observable in the mornings and evenings, especially near the wharves. This is much worse on the southwest part of the harbor, which receives the drainage of the Military Hospital, the gas works, arsenal, and the slaughter house. This locality is very unhealthy, and shows a fearful rate of deaths among vessels anchored there. After a heavy rain the disease is always worse in the harbor.

"A fact observable every summer also, is that vessels frequently discharge their cargoes, other than coals, and lie in the harbor a month or two waiting for an outward freight, without a single case of sickness on board, or with very mild cases only; but from the moment they commence to receive sugar or molasses, the latter especially, the crew will get sick, even when the labor of stowing the cargo is performed by men from the shore, the sickness always being severer on vessels where light cases were previously noted.

"The night air in the harbor is particularly dangerous, and crews will invariably contract sickness if permitted to sleep on deck, in certain localities of the harbor, with or without an awning."

"The statistics of death kept at Belôt Hospital show that, according to the places of anchorage of the vessels, the mortality [?] is as follows: East Regla and Triscomia, on the east and northwest sides of the harbor, seven to nine per cent.; West Regla, at the ferry crossing on the south part of the harbor, twelve to fifteen per cent.; at the wharves, twenty-five to thirty per cent.; Tallapiedra, gas works, and surroundings, southwest side of the harbor, fifty to sixty-five per cent."

This statement of Dr. Belôt is of value as indicating the grade of the infection to which crews are liable while their vessels are at anchor, and the facility with which the vessels themselves may be infected by the atmosphere of the locality which permeates every portion of the vessel. It was a knowledge of such facts which led the Louisiana State Board of Health to issue their circular of June 15, 1875.[1]

An attempt was made to obtain the Havana history of certain Spanish vessels, but without eliciting any other information than that which is con-

[1] *Annual Report of the Board of Health of the State of Louisiana*, 1875, pp. 8, 9, 10.

tained in a single paragraph of the letter of Dr. Belôt, already quoted: "No information whatever can be obtained respecting the crews of the vessels mentioned in your letter other than that the vessels left here having perfect health on board, and it is not likely that any had yellow fever on board before their departure." In lieu of any other evidence, this must be accepted as satisfactory until more complete evidence can be had. The circumstantial evidence against these vessels is strong.

It is known that the majority of the vessels trading between the South Atlantic and Gulf ports of the United States and Havana are those which, having carried a freight to Havana, sail in ballast for the United States for a cargo. The members of the crews of these vessels are not always protected against yellow fever, and that fact, with the varied incidents of a sailor's life, occasions frequent changes in the composition of the crews after such vessels reach Havana. It would, therefore, have been a matter of no small moment had we been able to obtain a full history of each member of the crews of the vessels we have before noted. We attempted to discover whether any seamen had been shipped on indicated vessels, and whether any of the members of the crews of such vessels had recently been inmates of hospitals; for it is a fact, that seamen who are convalescents in marine hospitals are frequently shipped directly from such hospitals; but no answers to such interrogatories have been received.

Although we have as yet no positive evidence as to the method by which yellow fever is diffused, still it is now generally considered by those who have large personal experience in its epidemic diffusion to be an acute infectious disease caused by a specific malignant poison which multiplies itself by its passage through the human system, and reproduces the same specific true yellow fever (Aitken) that the specific contagions may be reproduced with great rapidity in places where decomposing organic matter abounds: that it may be reproduced in an atmosphere impregnated with the emanations of decomposing animal and vegetable matter, and that, influenced by certain personal meteorological and telluric causes, the disease may be diffused by the migrations of individuals, the transportation of fabrics or volumes of atmosphere from infected localities, and lastly, that it is by no means necessary that the individual who may act as the porter of the contagion, should himself be the subject of the disease. This theory is sustained by certain well-founded and fully attested facts, and while it may be seemingly controverted by other facts which would appear to be equally well-founded, still it has the advantage of being a practical theory, one which places in the hands of its advocates a logical hope that hygienic appliances may yet be able to limit the diffusion of the disease.

As we have before intimated, no vessel known to be actively infected with yellow fever arrived at any of the United States ports at which the disease became epidemic prior to the occurrence of that epidemic; but it is equally true that the epidemic outbreak at Savannah, Brunswick, and Doboy Island, was preceded by the arrival of certain vessels from the Havana harbor, and that these vessels discharged ballast and took in freight at those ports, and that their crews had free and full intercourse with the inhabitants; therefore, a direct connection between a yellow fever infected district and uninfected district is established, and it is certainly wiser to study carefully each link in the chain of circumstantial evidence which may connect the infected and the healthy localities, than it is to discard it from all consideration.

The accompanying chart of the Havana harbor shows each of the four localities of infectious intensity which were noted in the letter of Dr. Belôt. From Captain George Brown of Savannah, who was for many years the master of a vessel in the West Indian trade, and who was a successful blockade runner during the late American war, we have received much valuable information as to the localities of the Havana harbor, to which vessels of the various classes are assigned for anchorage. The East Regla and Triscomia waters are occupied by war vessels, mail and passenger steamers, and vessels of the largest class; while in other portions of the harbor smaller vessels are placed indiscriminately. That which was known as the Rebel Hole, in which all blockade runners were placed, was off West Regla, and masters of such vessels all took position under protest on account of the extreme unhealthiness of the locality.

As nothing can be determined with any degree of positiveness in relation to the actual infection of any of the vessels to which attention has been, and will again be called, it is necessary to elaborate the circumstantial evidence at our command.

Each vessel which left the Havana harbor during the months of June, July, and August, 1876, must have carried out certain recognized factors of yellow fever. In each instance these factors were: (A.) The vessel herself, as from the fact that she had been at anchor in an atmosphere infected with yellow fever, that atmosphere must have permeated every portion of her hull. (B.) The articles of clothing and bedding of officers, crew, and passengers, which would unavoidably have been exposed to the infected atmosphere. (C.) The ballast with which they sailed, which varied greatly in quantity and character. We therefore propose to discuss these factors, by the light of the theory which we have adopted.

(A.) The vessel herself. Can a vessel which has been exposed to a yellow fever atmosphere become so contaminated with the disease that she may infect a healthy port, although no cases of the disease may have occurred on board?

Although instances are very numerous of the development of yellow fever epidemics after the arrival of vessels from infected ports, when the vessels have been known to have carried individuals sick with the disease, but few instances are recorded which show that epidemics which have occurred in healthy ports could be traced to vessels from infected ports, although the vessels may have exhibited no evidence of infection. The evidence which can be offered is embraced under the following heads: (*a.*) That epidemics of yellow fever invariably develop in localities near wharves at which vessels from infected localities arrive and unload. (*b.*) That vessels from infected ports carry the atmosphere of such localities sealed up under their hatches, and that the virulence of the infected air may be influenced by the local conditions of the holds. (*c.*) That in discharging the freight or ballast of such vessels, the infected atmosphere is also discharged. (*d.*) That the influence of such atmosphere has been clearly recognized at considerable distances from the point of its delivery.

The valuable report of Assistant-surgeon H. E. Brown, United States Army, which has been before noted, contains a careful digest of yellow fever history, and in its facts will be found corroborative of the above statements.

A vessel arriving in the Havana harbor and discharging cargo would at the same time discharge the air contained in her hold, which would immediately be replaced by the atmosphere in which she was then lying. During the time that she lay at anchor no change in the volume of air in her hold would occur. Therefore, if the air surrounding the vessel be charged with a contagion, it would undoubtedly be rendered more virulent by the confinement in the hold, where the local conditions invariably occasion a great degree of atmospheric pollution. The late Professor Parkes [1] wrote: "The air in the holds of ships is compounded of exhalations from the wood, bilge water, and cargo. Owing to the comparative immobility of the air, it often becomes extremely foul. The composition is not known, but the smell of sulphuretted hydrogen is very perceptible, and white paint is blackened."

If to air composed as above stated a specific poison be added, it is fully within the bounds of probability that by a process of proliferation of the specific cells, the entire volume of air would become contaminated and capable of diffusing the disease. The question is, therefore, considered as answered in the affirmative.

(B.) The articles of clothing and bedding of officers, crew, and passengers. Is it possible that the specific contagion of yellow fever may be transported through the medium of such articles?

Although at the present day it is almost universally accepted that fabrics which have been in domestic use are efficient media in the diffusion of infectious diseases, there is a tendency to disregard or to underrate that agency in the investigations of epidemic outbreaks; and in the history of no diseases is this a more constant occurrence than in the discussions attending the diffusion of yellow fever and epidemic cholera. The evidence, however, is so strong in favor of the truth of this theory, that to omit it from the consideration of an epidemic, most certainly invalidates any conclusion which may be reached.

It has been shown that fabrics have a varying power in the absorption and retention of foreign matters. In the absorption of the excreta, wool has more than double the power of either cotton or linen; the same is true as to the power to absorb odors and other atmospheric impurities, but this is influenced to a considerable degree by the color of the fabric, standing in the following order: black, blue, red, green, yellow, and white.[2]

[1] *A Manual of Practical Hygiene*, E. A. Parkes, 4th ed., p. 107. See, also, *Report on Sanitary Conditions of the Waterside and Seamen*, A. B. Judson, Met. Board of Health, 1869; and, "Sailors as Propagators of Disease," H. Smith, *Report of Marine Hospital Service*, 1874.

[2] Parkes, *Manual of Practical Hygiene*, 4th ed., p. 396.

Assistant-surgeon H. E. Brown, U. S. A.,[1] has recorded a number of valuable facts, which illustrate the power of fabrics in retaining and in diffusing this contagion. These instances are all worthy of study, and demonstrate conclusively the agency claimed; it is, therefore, unnecessary to enter into any lengthy argument.

(c.) The ballast with which vessels sail from Havana. Is it a media in the diffusion of the yellow fever contagium?

The ballast which is furnished vessels in the Havana harbor, by the company who control the business, differs greatly in its character and its cost. The various grades are: (*a.*) rock, or gray; (*b.*) white clay; (*c.*) sand; (*d.*) earth; (*e.*) ballast which has been brought in by vessels, discharged, and reshipped. The price varies from two dollars and fifty cents a ton, for that of the first grade, to one dollar a ton for the inferior qualities.

(*a.*) The rock, or gray ballast, is, according to some authorities, an impure brucite, or a hydromagnesite (hydrate of magnesia), associated with serpentine, many specimens showing variable quantities of the protoxide of iron.[2]

This rock,[3] according to Dr. Belôt, "is taken from the side of a hill in West Regla, about forty feet above the level of the sea. It exists nowhere on the island of Cuba, except in that particular spot."[4]

Dr. William I. Land, analytical chemist of Atlanta, Ga., by whom a chemical examination of a specimen of this class of ballast was made, reports that it consists principally of blue clay, which possesses great absorptive power, and contains a small amount of organic matter, namely: —

Specific gravity of ballast	2.315.
Organic matter (nitrogenous)	0.192 per cent.
Water (expelled at a red heat)	7.582 per cent.[5]

It being thought that ballast of this character is either inert, or that the clay of which it is composed is a neutralizer, which would prevent its being a medium in the transportation of disease germs, the following experiments were instituted to test the question: —

A pile of the gray ballast, which had been deposited at the Atlantic and Gulf Railroad wharves of Savannah from the Spanish barque *Maria Carlina* in August, 1876, was opened, and a small quantity was taken from a depth of about two feet below the surface.[6] The rock was disintegrated, damp, and dirty. In the quantity removed were found small pieces of wood,

1 Brown, *Quarantine on the Southern and Gulph Coasts*, pp. 49, 33, 52, 39, 34, 20, 40, and 68. See, also, *Report of the Louisiana State Board of Health*, 1875, p. 224.

2 *The Causes of the Epidemic Yellow Fever at Savannah, Ga., in 1876*, by Surgeon A. A. Woodhull, U. S. A. *American Journal Medical Sciences*, July, 1877, p. 37.

3 It had been hoped to have obtained a more careful and extended analysis of this rock, but my unexpected order to the Pacific coast rendered it impossible.

4 Letter of February 28, 1877, to author.

5 *Report of the Georgia State Board of Health*, 1876, Appendix, p. 51.

6 This ballast was removed in the presence of the Hon. John Screven, president of the Atlantic and Gulf Railroad, and Surgeon A. A. Woodhull, U. S. A. The locality from which it was taken was pointed out by the wharfinger.

some fragments of matting, and a small piece of red brick. This was in the month of December, 1876.

About half a pound of this ballast was placed in an ordinary flint glass preserve-jar. Upon it distilled water was poured sufficient in quantity to fill the jar two thirds full. The jar was then hermetically closed. About one drachm of the same variety of ballast was then placed in each of two large test tubes, which were corked as tightly as possible. During the winter months the contents of the jar and of the two test tubes remained unchanged. The water was clear and transparent, the surface of the ballast seemed to be covered with fine sand, evidently deposited after the agitation caused by the railroad journey from Savannah to Atlanta. In the early spring the specimen in the large jar was exposed to the sun, and as the season advanced, and the heat became more intense, gas in considerable quantities was evolved, and gradually the glass walls of the jar became covered with a vegetation, which, when detached, floated in the water suspended by a globule of oxygen. Fungoid growth covered the surface of the earthy matter. The rock by this time was utterly disintegrated, and showed no resemblance to its former condition. This jar has never been opened since it was closed in Savannah.

During this time the two test tubes and their contents had been excluded from the light, and had been kept in a cool place. In August, 1877, no change could be observed in the contents of either tube. They were now exposed to the sun for several days, and the water from one tube subjected to microscopic examination. A number of specimens were examined, and the following objects were recognized: Bacteria, epithelium, spores of fungi, touelas, mycelium, etc., diatoms, particles of mineral matters, fibres of wood, cotton and wool hairs. A portion of the liquid contents of the second tube were added to Pasteur's liquid in several test tubes. The mixture became milky after a few days' exposure, and microscopic examination discovered monads and tod bacteria in large numbers.

To the small amount of liquid remaining in this tube, about one drachm of Pasteur's liquid was added. After three days' exposure to the sun, the fluid was found to teem with monads and bacteria.

These experiments were made under the observation of, and have been verified by, Lieutenant-colonel I. F. Head, surgeon U. S. A., Medical Director Department of the South, to whose skill in microscopic examinations the success of the observations is in great measure due.

It is not claimed that these experiments have demonstrated that the specimens of ballast *were* infected with the yellow fever contagion, but it is claimed that they conclusively show that the gray ballast is not the inert mass which has been claimed. It cannot, therefore, be discarded as a *possible* factor in the epidemic diffusion.

(*b.*) White ballast, which is, according to Dr. Belôt, a dry marl, a carbonate of lime, and is taken from a hill near Casa Blanca, on the east side of the harbor. No specimens were obtained.

(*c.*) Sand ballast, which, according to the statements of several shipmasters, is taken from West Regla.

(*d.*) Earth ballast, which consists of rubbish, and, according to the statements of shipmasters, is taken from a large pile of débris east of the city, in what is known as Tallapiedra, and near the gas works, the military, and other hospitals.

Dr. I. S. Blain, the health officer of Brunswick, Ga., writes that he carefully examined a quantity of ballast of this class, which was discharged in 1876 from the Spanish bark *Marietta*, and found it to be composed of dirt, palmetto leaves, rags, and rubbish of all kinds, which the word "filthy" describes very perfectly.

(*e.*) Ballast which having been used is again sold. A small quantity of ballast of this class, supposed to have come originally from Liverpool, was collected at the Atlantic and Gulf wharves of Savannah, and was submitted to Dr. W. I. Land, of Atlanta, for analysis. The exact history of the specimen was and is unknown. It was found to consist of ordinary soil, containing débris, as smith's cinders, fragments of coke, etc., and the determination was as follows, viz.: —

Specific gravity	2.269
Organic matter (nitrogenous)	0.347 per cent.
Water (expelled at a red heat)	5.325 per cent.[1]

In relation to ballast from Havana being a medium by which the contagion of yellow fever may be diffused, Dr. Belôt writes in the letter already quoted: "I do not believe that the fresh ballast referred to (gray) will of itself in any way influence the development of yellow fever: if such were the case, the disease would manifest itself as soon as the ballast is taken on. However, if the same ballast is taken into a leaky vessel after being thoroughly saturated by rain, it will undoubtedly produce miasma when it comes in contact with offensive bilge water. This ballast, when removed, must be dangerous. Quantities of ballast are brought to this port, discharged here, and again sold to other vessels leaving in ballast, or as is sometimes done, transferred from one vessel to another. Such ballast, if impregnated with offensive bilge water, can hardly fail to cause sickness."

We have been informed by several shipmasters whom we have interviewed on the subject, that at the Havana vessels are generally furnished with ballast, while lying at anchor, the material being brought off on flats or lighters; that the sand ballast is considered objectionable for many reasons; that the gray and white varieties are both scarce and costly, being sold at two dollars and fifty cents per ton, while the inferior grades are sold at one dollar. The master of the bark *Nellie May* informed the health officer of Brunswick, that he had many times been obliged to leave the Havana short of ballast, being unable to procure a full amount.

The facts which we have presented are definite enough to warrant the presumption that the ballast of vessels from the Havana harbor should be considered as media by which the yellow fever contagion may be diffused in years in which the disease may be epidemic. It is presented as a matter which should be carefully investigated. The gray ballast when

[1] *Report of the Georgia State Board of Health*, 1876, Appendix, p. 51.

dug from the hill in West Regla is probably inert; but the very fact that it is carried upon a lighter through a portion of the harbor which shows an excessive mortality in yellow fever cases, places it at once under suspicion. The absorptive power of the mass is so great, that the few hours it remains on the lighter may be sufficient to impregnate it with the germs of the disease, and this would be almost certain to occur should it be wet by rain during the passage. The evidence, as it now stands, that ballast of inferior grades may be infected by débris from hospitals is very strong, and until it is disproved cannot but be considered as an important factor in epidemic diffusions.

In discussing the question of the liability of vessels from infected ports to be media by which yellow fever contagion may be diffused, it is a matter of vital importance to investigate all facts which may be learned as to the crews of such vessels. At the three ports now under consideration, we find that the habits of the crews of Spanish vessels differ.

While in the port of Savannah the seamen from such vessels go with their personal effects into boarding houses, where they remain until their vessels receive their cargo and are cleared, at both Brunswick and Doboy Island the crews do not leave their vessels, except for short periods, but continue to eat and sleep upon them.

We shall, therefore, confine our attention to the habits of Spanish seamen while in the port of Savannah.

From the 14th of July to the 18th of August, 1876, six Spanish vessels arrived at the port of Savannah,[1] having a total number of seventy-five individuals in their crews. These seamen, with their bedding and clothing, which amounted to forty-eight packages, lodged at the house of a Mrs. Redgate, on the corner of Price and Bryan streets. The officers of these vessels lodged at the house of one Ruiz in the immediate vicinity.

At the Redgate house the sailors took possession of a large room in which they slept, but took all their meals upon their vessels. They are described as quiet, orderly men, who are inclined even in their vices to be methodical, and it is presumed that they are not more virtuous than seamen generally, from the fact that the quarter of the city which is their favorite haunt abounds in drinking-shops and houses of prostitution (these localities will be found indicated on Charts I. and II.); and it is a matter of some import to note that three of the early cases of yellow fever (August 18th and 20th), occurred in houses of prostitution, two of the cases being prostitutes, the other the young child of a woman of that class. Nothing can be learned as to the Havana history of these seamen. They may have been convalescents from yellow fever hospitals; they may have been members of the crews of yellow fever infected vessels; or they may have been neither. One thing, however, is certain, they had been exposed to the yellow fever atmosphere of the Havana harbor, and they were in the port of Savannah after but comparatively a few days had passed from such exposure. Nothing is known of any of these vessels after they left Savannah. The first three vessels remained in that port but a short time. The *Yñes* was twelve days;

[1] *Report of the Georgia State Board of Health*, 1876, Appendix, p. 34.

the *Maria*, sixteen days; the *Pepe*, seven days. The *Yñez*, therefore, cleared from Savannah twenty-three days after leaving the Havana; the *Maria*, in twenty-four days; the *Pepe* in twenty-six days. It is, therefore, unwise to state that none of the seamen of these vessels could have been infected with yellow fever before leaving the Havana, for a sufficient time is not given to have passed the limits of the period of incubation.

The period of incubation has generally been noted as extending from two to fifteen days; but through the courtesy of Dr. George H. Stone, of Savannah, we are in possession of the facts of a case which proves that the limit must be extended.

"The steamer Junietta left Savannah on the 23d of September, 1876. She was kept in quarantine below Philadelphia for thirty days and arrived back in Savannah October 25, 1876, making an absence of thirty-three days. As the steamer rounded Cape Hatteras, John Reynolds, one of the crew, who was on the steamer when she left Savannah and who had been exposed to the infection, was taken sick and was sent to the Marine Hospital immediately on the arrival of the steamer at the wharves. He had a well marked case of yellow fever. In this case a period of thirty days passed after exposure before the development of the disease."

In the view of this subject, which must be taken after the case of John Reynolds is known, it must be admitted that on either the *Yñez*, the *Maria*, or the *Pepe*, cases of yellow fever may have occurred after those vessels had cleared from Savannah, but which had their origin in Havana. What influence such cases may have had in the diffusion of the disease in Savannah, is a matter of mere conjecture. One fact alone is certain, none of the seamen from these vessels in the months of July or August were reported sick, and no early cases of yellow fever occurred among the other occupants of the Redgate or Ruiz houses, nor did any cases occur in their immediate vicinity until the epidemic was fully established — but then, the district suffered severely.

THE YELLOW FEVER EPIDEMIC AS IT AFFECTED SAVANNAH.

So much has already been written upon the yellow fever epidemic of 1876 in Savannah, that there is scarcely an excuse for making any addition to the mass of information already in print,[1] but as it is desirable that all facts should be developed, we are compelled to present certain links in the chain

[1] I. *Report of Dr. George H. Stone, Surgeon United States Marine Hospital Service, to the Supervising Surgeon General*, 1876.

II. *Report on the Yellow Fever as it appeared in Savannah, Ga., in 1876*, by Octavius A. White, A. M., M. D. New York, 1877.

III. *Report of the Georgia State Board of Health*. Atlanta, 1877.

IV. "The Causes of the Epidemic of Yellow Fever at Savannah, Ga., in 1876," by Surgeon A. A. Woodhull, United States Army, *American Journal of the Medical Sciences*, July, 1877.

V. "The History, Causes, Nature, Pathology, and Treatment of Yellow Fever, considering exclusively the Epidemic of 1876 in Savannah," by I. C. LeHardy, M. D., *Transactions of the Medical Association of Georgia*, 1877.

VI. *Report of Citizens' Committee of Investigation of the Causes of the Yellow Fever Epidemic of 1876*, Savannah, 1877.

of epidemic diffusion which have impressed themselves strongly upon our mind, although they have been passed over by other investigators.

That there existed in the city of Savannah in the summer of 1876 certain factors of miasmatic disease is undoubted.

The soil in and around the city was polluted by deposits of human excrement and other animal débris.

Comparatively few of the Savannah houses are provided with sewer connections. The excrementitious matter is either deposited in open pits or in dry wells, the latter also serving as the receptacle of all other house drainage. Of the two the open pit is the least objectionable, for the gases given off and the organisms which such gases may carry, are at once diffused and subjected to the action of the natural forces, whereby the morbific influence which they might exert is in a measure counteracted. From the dry wells, owing to faulty construction, the gases penetrate the surrounding soil, but not infrequently they find access through the service pipes to houses, with greater facility than they do into the soil. It has heretofore been customary when a privy vault becomes inconveniently full, to remove its contents into a pit dug close by and to bury the filth; but the dry well is rarely if ever cleansed, — the fluid contents drain off into the adjacent soil, while the solids are permitted to accumulate.[1] Surgeon A. A. Woodhull, U. S. A., in his elaborate inquisition into the causes of the epidemic in question, notes the fact "that fœcal matter has actually been thrown up into a wash basin connected with such a well, and we are in possession of the details of several severe house-epidemics of fever, which were traced to the escape of gases from dry wells.

In a measure the evil influence of the soil pollution is counteracted by the city sewers, which are so constructed that they act as deep soil drains. By some, notably those of Broughton and East Broad Streets,[2] from the depth at which they are laid, the ground water is constantly drained off, but in other portions of the city, where the sewers are laid nearer the surface of the ground, in times of low ground water, their fluid contents escape into the surrounding soil. The majority of the city sewers come together, on the southeastern limits of the city, and terminate in a large ditch which is known as Bilbo Canal, which having traversed the eastern face of the city, empties into the Savannah River. A few of the city sewers empty into the river on the city front. During the summer of 1876, Bilbo Canal was notably offensive, and large amounts of organic matter were known to have been deposited therein.

The water supply of the city was polluted.

The wells, which are so numerous within the city limits, must of necessity

[1] The depth of the dry wells varies. Many are carried down as low as the spring level of the water, which varies from ten to twenty-five feet: generally the depth is from twelve to fifteen feet. The cesspools or water inlets communicating with the sewers are six feet deep and are furnished with the ordinary water-trap. Note from the City Surveyor, I. B. Hogg.

[2] The Broughton Street sewer varies from nine to sixteen feet in depth, while that of East Broad Street is from sixteen to ten feet. The Bolton Street sewer is at an average depth of ten feet.

be influenced by the soil pollution. They vary in depth according to their distance from the river. At the top of the bluff nearest the river, they are about twenty-five feet deep, and diminish to a depth of eight feet near the southern boundary of the city. In some portions of the city the water of these wells became so impure that they were abandoned. The public water supply is derived from a reservoir on the western limits of the city. At each half flood tide, the river water is let into this reservoir. Two hundred and thirty feet below the mouth of the supply inlet, two sewers empty into the river, while immediately above and in part into this inlet the drainage of all the low ground west of the city (upon which are large accumulations of garbage) debouches. As a consequence the water in the reservoir is largely contaminated with organic débris. The air was polluted by emanations from the soil, from the numerous privy vaults and cesspools, from the contents of Bilbo Canal, and from the vast area of swamp lands with which the city is surrounded. An examination of the map of Chatham County will show how hopeless would be the task of attempting to defend the City of Savannah from marsh miasm.

During the early summer months of 1876, there had been an unusually heavy rain fall. The low lands west of the city had been submerged for several weeks. Then followed a season of excessively hot and sultry weather, the intensity of which exceeded that of any summer for many years.

The suburbs of the city were in bad sanitary condition. The population was dense, and being of the lower classes of whites and blacks, the inevitable consequences of overcrowding were apparent; but with all these factors of disease in active operation, it was not until the last of the month of August, or the early days of the month of September, that any manifestations of disease caused apprehensions of danger.[1]

Events here demonstrated that to the factors which have been enumerated, an additional one was added, and that from the combination thereby effected the epidemic explosion occurred. How this additional factor was obtained we shall attempt to demonstrate.

The first fully recognized and acknowledged case in the Savannah epidemic of 1876 occurred on the 21st day of August. So soon as investigations into the out-break were commenced, it was found that the case of August 21st had no claims to priority in the epidemic, but that it was preceded by several cases which could be fully authenticated, and from these it was discovered that the earliest case which could be connected with the chain of epidemic diffusion occurred on the 25th of July.

[1] In the month of June, three cases of sickness occurred in the city which are now considered by the medical gentleman in charge of them, a man of large experience, to have been cases of yellow fever. Two of these cases were in the heart of the city, the third a short distance in the country. They occurred between the 5th and 14th of June, and all recovered. One of these cases is discussed in the *Report of the Georgia State Board of Health*, 1876, Appendix, p. 9. These cases are isolated. They are connected with no other cases, either preceding or succeeding, and were in all probability cases of a high grade of bilious fever, and not yellow fever. They might, perhaps, be classed as of the malarious yellow fever of Aitken. They certainly had no connection with the epidemic diffusion, which occurred after a lapse of sixty-eight days from the date of the last of the three cases.

The history of this epidemic diffusion, as viewed from our stand-point, is as follows: —

On the 11th of July, 1876, the American schooner *Sever* arrived at Savannah from New York, with a cargo of ice, which she discharged at the warehouse opposite the foot of Barnard Street. On the 15th of July she dropped down to the Atlantic and Gulf Railroad wharves to load with lumber.

On the 16th of July the Spanish brig *Yñez* arrived at the same wharves and made fast about one hundred feet above the *Sever*. Such facts as could be learned as to the *Yñez* have already been given.

On the 17th of July, the Spanish bark *Maria* arrived at the same wharves, aad made fast about four hundred feet below the *Sever*. Such facts as could be learned as to the *Maria* have already been given. Immediately upon arrival both of the Spanish vessels began to discharge their ballast, which work was performed by negro stevedores.

On the 25th of July, the steward of the *Sever*, a white man named G. W. Schull, was ill on board that vessel. How many days he had been indisposed is not known, but upon the date given he was put into a small boat, in which he was carried from the wharves to the extreme western portion of the city, where he was taken into the boarding-house of Mrs. Hearn, at the corner of Indian and Ann Streets. (See Chart No. I.)

This removal was effected ten days after the *Sever* had reached the Atlantic and Gulf wharves; nine days after the arrival of the brig *Yñez*; and eight days after the arrival of the bark *Maria*.

Schull remained in the house of Mrs. Hearn for two days, during which time he was visited professionally by Dr. William Duncan; but on the afternoon of July 28 he was taken to the United States Marine Hospital (St. Joseph's Infirmary), at the corner of Taylor and Habersham Streets (see Chart No. II). This removal was effected without the knowledge of Dr. Duncan, and the vehicle employed was a public hack.[1]

On the 30th of July, Schull's case terminated fatally. He had been treated both at the Indian Street house and at the Marine Hospital for malarial fever and congestion of the lungs. The official record is as follows[2]: —

"On the 30th of July, whilst sitting up in bed calm and cheerful, he was taken with sudden hemorrhage. The blood escaped in large quantities from his mouth, was red and frothy, death ensuing almost immediately." Post mortem four hours after death. "Skin yellow, lungs infiltrated and filled with blood, traces of incipient tubercle in lungs, ulcers on the exterior surface of same. Liver of complete boxwood color." This autopsy caused the first suspicion of yellow fever to be attached to the case. Of it Dr. Stone writes, "I gave notes of the case on my monthly report for July, with the observation that the case was only interesting in the event we should have yellow fever this season in Savannah. With the light of several cases of yellow fever resembling this, which have come under my observation during the epidemic, I am inclined to think it was yellow fever."

[1] Woodhull, *Causes of Epidemic Yellow Fever at Savannah*, p. 45.

[2] Stone, report quoted.

The autopsy on the body of Schull was made in the dead-house of the hospital. We are informed by Dr. Stone, that, with the exception of removing the calvarium, a full and complete examination was made. The autopsy completed, the buckets and tubs which had been used for receiving fluids were emptied into a water-closet in the hospital yard. This closet is so constructed that a water-tight box receives all deposits, which are washed by a full head of water into an underground drain. The amount of organic matter to be disposed of after an autopsy is of course considerable. There is blood in some quantity, the fluid contents of serous cavities, the contents of the stomach and intestines, and the débris of organs which have been subjected to especial observation. The body of G. W. Schull was duly deposited in the grave, less some important constituents which had been emptied into the hospital drain. The sewer connections of this hospital had been completed but a short time prior to Schull's death, and the regulations as to the flushing of the privy-box were, therefore, fresh in the minds of the attendants. We have been assured that this work was carefully performed each day, and there is no reason for thinking that on the day of the Schull autopsy there was any deviation from the general rule. The drain from the hospital extends along Habersham Street to Charlton Street, at which point it joins a chain which follows the line of Charlton Street to East Broad Street, where it empties into one of the sewers of the city system.[1]

The organic matter abstracted from the body of Schull must have been rapidly removed from the vicinity of the hospital. So long as it remained in the deep sewers no active decomposition would take place ; but in these sewers it would become mixed with fœcal and other organic matter, and when this organic matter, bearing the specific germs of the disease, became exposed in Bilbo Canal (which was at the time filthy beyond expression) then decomposition rapidly occurred, to be followed by as rapid a proliferation of the specific germ, until the entire line of the canal breathed forth pestilence.

For the proper elaboration of this theory, it is necessary to more fully describe the sewers to which attention has been called.

The drain from the hospital commences with a pipe which has a diameter of nine inches. In the portion laid on the line of Habersham Street, the diameter of this drain is enlarged to fifteen inches. The hospital drain has a fall of thirty inches in 475 feet. The sewer on the line of Charlton Street is an oval of nineteen by thirty inches, and has a fall of twelve inches to one hundred feet. The Charlton Street sewer joins the East Broad Street sewer, which has a fall of three inches to the hundred feet; which empties into the Bolton Street sewer, which has a like fall.

From the Marine Hospital to the mouth of the Bolton Street sewer, is by the line of sewers a distance of 6,300 feet ; therefore a fall of three inches to the hundred feet would give to it a fall of fifteen feet and nine inches.

[1] Upon all maps of Savannah which have been published the Habersham and Charlton Street sewers are not noted, for the reason, as we have been informed by the City Surveyor, that, as they were laid for the improvement of private property, they did not come within the control of the city authorities.

Any one who has stood at the mouth of the Bolton Street sewer and has watched the rapid flow therefrom, would be convinced that there is little or no obstruction in the sewers whence the stream is derived. The discharge from the mouth of that sewer in August, 1877, according to the formula of Dr. Parkes,[1] is seventy-two cubic feet per minute. M. John B. Hogg, to whom we are indebted for much valuable information, writes "that early in the day, say until ten o'clock, excrementitious matter in considerable quantity is discharged, but it is so disintegrated that it is only observable in small particles except where rags and paper are discharged with it. After this the water is quite clear, showing that spring water must force its way up through the bottom and sides of the sewer. During very heavy rains the sewer at its mouth is somewhat more than half full; its diameter being ten feet."

For all practical purposes the Bolton Street sewer empties into Bilbo Canal, although the old rice field ditch from which the name is derived terminates at the crossing of the Thunderbolt Road, which must be considered as the dividing line between the old and the new canal. The latter was dug after the present system of drainage was established, and consists of a rather tortuous ditch, 2,400 feet long and twenty feet wide on its bed. The Bilbo Canal proper is 4,500 feet long, twenty-five feet wide on its bed, and, with the exception of a single curve which is nearly at right angles, holds a straight course to the river. The stream of sewage after leaving the Bolton Street sewer gradually loses its velocity, and by the time it reaches the point at which the Thunderbolt Road crosses the canal is reduced to a sluggish stream in which organic matter is deposited on numerous bars which have formed in the channel or upon the line of the banks.

The canal is crossed by the Thunderbolt Road, one of the main avenues to the country. At this point the track of the Atlantic and Gulf Railroad crosses the canal and runs along the eastern bank until within about three hundred feet of the river. At the point of departure of the railroad, the canal is crossed by the wagon road to and from the Atlantic and Gulf wharves. The distance of Bilbo Canal from the nearest inhabited blocks of the city varies from 1,500 to 2,700 feet. This stream of sewage is, therefore, within a sufficient distance of human habitations to exert a marked influence upon the health of their inhabitants.

The land between Bilbo Canal and the line of City Street, and north of the line of Liberty Street, known as the Lamar lands, is cultivated as a farm, under the dry culture contract.

The contents of Bilbo Canal, for the five days following the 31st of July, were exposed to a temperature the mean of which was 80° F., while the means for the month of July and August were respectively 84.5 and 82.1. The tables of humidity show a monthly mean of 68.7 for July, and 72.6 for August. This record is taken from the United States Signal Station at Savannah, and it is more than possible that had observations been made upon the banks of the canal itself, a higher temperature would have been recorded.

[1] Parkes, *Manual of Hygiene*, p. 348.

Parkes[1] states that the fluid of sewers is generally warmer than the water of streams, and, if this be the case, then the organic matter from the body of Schull must have been in condition to rapidly undergo decomposition, when it was exposed to the direct rays of the sun; and as it is in direct evidence that "the torrid sun generated gases that bubbled up through the slimy coating, so that along its whole course the senses of sight and smell were offended," it is no improbable creation of the imagination to suppose that from the specific germs of yellow fever abstracted from the body of Schull, and deposited in the filthy canal, an abundant harvest was speedily gathered.

Surgeon A. A. Woodhull (whose report deserves the most careful study, for it demonstrates with exactness the local causes of disease which existed at Savannah, prior to and during the epidemic) points to the stream of sewage flowing through Bilbo Canal as a most important factor in the diffusion of the epidemic influence, and he further demonstrates in the most conclusive manner that from this source the disease was diffused. We claim to have demonstrated, in a practical manner, the method by which Bilbo Canal became infected, and it is believed that the evidence is sufficiently strong to do away with any theory of spontaneous generation.

It has, however, not yet been established how or where Schull contracted yellow fever, for of that disease he undoubtedly died. He had been in Savannah but fifteen days when he was first known to have been sick. Prior to his death (which occurred five days after he left the vessel), and for twenty-two days thereafter, the presence of the disease in the city was not known. Had there been any local causes of sufficient virulence to have caused this malignant demonstration of the disease in the person of Schull, it is but natural to suppose that other cases would have developed at or about the same time in other portions of the city; but such was not the case, for it can be conclusively shown that the succeeding cases were exposed to exactly the same causes as was Schull.

It was at one time stated that Schull was upon terms of intimacy with the steward of the *Yñez*; but this has been disproved by M. H. Williams, the first mate of the *Sewer*, who asserts that Schull had no intercourse with either of the Spanish vessels, and that he did not even go upon the wharves. We are of the opinion that the extent of this testimony impairs its value. Schull was on board of the *Sewer* for ten days after she reached the Atlantic and Gulf wharves. He could not have been considered as being dangerously ill when he left the *Sewer*, or he would have been sent at once to the Marine Hospital and not to a boarding-house. If he were able to perform his duties, their nature would have required him at times to leave the vessel, while if he were indisposed the natural impulse would have been to take as much fresh air as possible. It was in evidence before the Citizens' Investigating Committee of Savannah that, on the day he died, he had requested a comrade to support him backwards and forwards in the ward, as exercise and air always made him feel better. The little that is known of

[1] Parkes, *Manual of Hygiene*, p. 338.

Schull stamps him as an active man, and not one who would be likely to remain confined to his vessel. We are, therefore, compelled to reject so much of the testimony of Williams as states that during the ten days following July 15 Schull was not on the Atlantic and Gulf wharves.

Neither of the Spanish vessels (the *Yñez* or the *Maria*) had any yellow fever on board when they arrived in the Savannah River, but they had on board ballast, which they had received in the yellow-fever-poisoned air of Havana. They had more than the ballast on board, for they carried a volume of that air in their holds, and when the ballast was discharged this volume of air was also discharged. To become infected with yellow fever from this infected air, it was not necessary for Schull to board either of the Spanish vessels. If the story of Williams be absolutely correct, and Schull on account of indisposition did not once leave the *Sewer* while at these wharves, he was certainly in a most favorable condition for being influenced by the contagium. The three vessels lay so close together that there is nothing improbable in the theory that the atmospheric infection occasioned by the discharge of ballast and air occasioned Schull's illness; nor is it at all unusual that of the crew of the *Sewer* Schull alone was in condition to receive and develop the infection. The evidence that he did become thus infected is but circumstantial, therefore it would be unwise to assert it as a positive fact; but it is most mischievous to positively assert that he was not thus infected, for by so doing all hope of fathoming the mystery is destroyed, and there is nothing left upon which to build hopes of obtaining immunity for the future.

But this evidence, circumstantial as it is, is not left with the case of Schull alone as an illustration, but the chain is strengthened by other cases which may be traced to the same cause.

Seven days after the death of Schull a case occurred which is deserving of careful study. On the 6th of August, a white boy named Thomas Cleary, fifteen years of age, who lived on Wright Street, in the extreme eastern portion of the city, was taken ill with what is now believed to have been yellow fever. His mother, an intelligent woman, states "that he was taken sick with pains in his bones, with yawnings and stretchings, and became so weak and staggery that he had to go to bed. Had fever and great pain in the front part of his head; wanted to drink all the time; had very short breath, and said he felt as if he had to gasp to get it. When he got up he was very weak, could not walk, and was yellow all over."

This case was not seen by any medical man until he was convalescent, but the case has been frequently investigated, and it is believed that no doubts exist as to its genuineness. The conditions of the locality in which this case occurred have been carefully studied by Surgeon Woodhull, and will be found accurately described in his report.

Thomas Cleary states, that during the month of July, 1876, he, in company with several other boys, named James McCarty, George Bussell, Bill Ray, and George Lappin, was in the habit of going after school hours to the wharves of the Atlantic and Gulf Railroad, to play and to look for shells and rocks amongst the ballast discharged from vessels.[1] To the truth of his statement Cleary made an affidavit, which is in our possession. The residence of this boy will be found on Chart No. II., marked 2, and the locality of cases, hereinafter to be described, will be found on the same chart, indicated by figures.

Of these comrades of Cleary, in his visits to the wharves, all were subjects of similar attacks during the month of August. James McCarty (3), who lived on East Boundary Street, north of Broughton, almost in the rear of the Cleary house, was taken sick about the same time Tom Cleary was sick, or a few days later. Bill Ray (4), who lived at the corner of Broughton and East Boundary, was taken sick on the 21st of August. George Bussell (5), who lived on East Boundary Street, south of Broughton, was taken sick August 23d. George Lappin (6), who lived on the east side of East Broad Street, south of Wright Street, was taken sick August 30.[2]

None of these cases terminated fatally. They all presented the same symptoms, and none of them had yellow fever at any other time during the epidemic, although they all lived in a district which suffered severely from the disease. The five boys were subjected to the same atmospheric influences as was Schull, they were even more exposed than he was, for they were in the habit of handling and digging into the piles of ballast. The fact of their having any inducement to examine the ballast piles has been discredited on the supposition that it was the gray ballast alone which was brought to the wharves; but we have shown that there is good reason for supposing that the ballast was not all of that grade, but was mixed in quality. There must have been some inducement for boys to go to these wharves, as it has been shown that these six boys were not alone in these visits, as will be noted hereafter. It has also been stated that these boys, in addition to their visits to the wharves, were in the habit "of fishing in and raking things out of Bilbo Canal."[3] When indulging in the last-named amusement, to have found any articles which would excite their cupidity, it would have been necessary for them to have gone to the upper portions of the canal, where it has been shown that bars had been found in the stream on which deposits were made, and therefore they would have been brought in contact with the specific poison which had been abstracted from the body of Schull. Therefore, at either point, they were in an atmosphere impregnated with yellow fever contagium.

On the 15th of August, Richard Grandison (7), a mulatto boy of seven years of age, who lived on Randolph Street, north of Liberty, was taken ill with what is now considered to have been yellow fever, and died on the 18th. Surgeon Woodhull has conclusively traced the source of infection in this case to Bilbo Canal.[4] The boy was accustomed to take a pet dog to swim in the canal. The point to which he would naturally go would be

[1] *Report of the Georgia State Board of Health*, 1876, p. 111.

[2] The illness of McCarty was the most prolonged, for on the 18th of August Dr. I. B. Read was called to the case. Up to that date he had no medical attendance.

[3] Woodhull, *Causes of Epidemic Yellow Fever at Savannah, in 1876*, p. 38.

[4] *Ibid.*, p. 40.

just below the Thunderbolt crossing. He was first known to be sick sixteen days after the organic débris of the Schull autopsy is known to have been thrown into the sewer from which it must have reached the canal. We must, therefore, conclude that this case of Grandison was but a sequence of the case of Schull.

On the 17th of August, James Patrick Cleary (8), a younger brother of Thomas, was taken with yellow fever, of which he died on the 21st. This was the first fully recognized case of the epidemic; but the case was not known until the day of death, when Dr. Stone was first called in. James Patrick was a delicate boy who suffered from hip disease. He was rarely from home, and, from his physical condition, was unable to join boys of his age in their sports.

On the 18th of August a young child (9), on Reynolds Street, north of Broughton, was taken sick with what is now known to have been yellow fever. It recovered, but other cases occurred within a few days in the same house.

On the 19th of August, John Conners (10), a boy about ten years of age, who lived on York Street, near Price, was taken sick with what Dr. E. Younge was at first inclined to think was cerebro-spinal meningitis, but which he now regards as having been a mild attack of yellow fever. Dr. Woodhull has shown that this boy was in the habit of frequenting the Atlantic and Gulf wharves, and also Bilbo Canal. What the inducement for so doing was in this case is difficult to imagine, for the boy denies the attractions which the other boys admit; but even if he indulged in none of the sports of the other boys, but always conducted himself with the propriety claimed, still he did inhale the atmosphere of the two localities, and he must be considered as the seventh case of yellow fever which occurred after frequenting these wharves after the Spanish vessels began to discharge ballast; and it must be remembered that to this date (August 19) two other Spanish vessels had arrived and had discharged their ballast; namely, the *Maria Carlina* and the *Profita.*

On the 20th of August two cases of yellow fever occurred on Reynolds Street, north of Broughton (11 and 12); one case recovered, the other died. One case was in the same house in which the case of the 18th had occurred. Both of these cases occurred in low houses of prostitution. Other cases, fatal and non-fatal, rapidly followed. The disease spread from each focus as it was established, and the epidemic in the eastern section of the city was fully developed.

While the events which have been narrated were occurring in the eastern section of the city, it was evident that the extreme western sections of the city were involved in the same epidemic influence. Three foci were early established, which seem to have derived their infection from two distinct causes.

I. The presence of Schull at the boarding-house of Mrs. Hearn on Indian Street.

II. The epidemic influence already in existence in the eastern section of the city.

It is, therefore, proposed to consider the early cases which occurred under this classification. After the departure of Schull from the house of Mrs. Hearn, the family of David Coleman (a son-in-law of Mrs. Hearn) moved into the room which had just been vacated by Schull. The bed and bedding which had been used by Schull was used by this family.[1] "On the 1st of August, an infant child of Coleman was taken with fever which continued for several days; but the symptoms were not sufficiently marked to pronounce it a case of yellow fever at the time. The child remained in the house during the whole epidemic and was not again sick, although there were several cases of pronounced yellow fever during the summer in the same house."[2]

On the 17th of August, a young child named Magner (5) [see Chart No. I.], who lived on Indian Street, at the opposite corner of Ann Street from the Hearn house, was taken ill with what is now considered to have been yellow fever, but recovered.

On the 18th of August, David Coleman was taken with fever at Darien, Ga., where he had been for one day. The next day he returned home to the Hearn house. "His fever continued for several days; the case was not at the time recognized as one of yellow fever, and was not sufficiently pronounced to produce an impression upon the minds of those in attendance. The fact, however, that he was not sick at any other time during the epidemic would go to show that it was a mild attack of the fever."[3]

On the 22d of August a man named Hatch (10), who lived on Ann Street, two doors from the Magner house, was taken with yellow fever, but recovered. On the same day a man named Thompson (9), who lived on Indian Street Lane, was taken with yellow fever, of which he died on the 29th. On the 26th, the wife of this man took the disease, but recovered. A third case for August 22 is reported in the person of a boy named Fallon, who lived on Indian Street, opposite the Magner house. The case recovered.

On the 24th of August a child of Mrs. Flynn, who lived on Ann Street, between the Magner and the Hatch house, was taken with yellow fever, and on the same day a young girl named Hanly, who lived quite close to the Thompson house, was taken with the same disease, of which she died September 1. Following these cases in this locality (the Indian Street focus) the disease spread, and from September 1 to October 7, a total of fifty-seven deaths are reported from yellow fever.[4]

We have until this time purposely omitted any note of the case of Lawrence Kelly, who claims that on the 11th of August he was taken with yellow fever, which he contracted while discharging the ballast from the Spanish brig *Pepe*, at the wharves of the Central Railroad, west of the city.

[1] Woodhull, *Causes of Epidemic Yellow Fever at Savannah*, p. 44.

[2] From a note of Dr. William Duncan. During the month of August fifty-three cases of yellow fever are now known to have occurred in the eastern foci, and in the same period twenty-five cases occurred in the western districts.

[3] From a note of Dr. William Duncan, who attended all the cases reported in the Indian Street focus to the last date given.

[4] *Report of the Georgia State Board of Health*, 1876, p. 114.

The *Pepe* arrived at Tybee five days out from Havana; she was quarantined three days. This case has occasioned much controversy. Kelly was (according to his statement) seen but once by any medical man, who pronounced the case one of malarial fever. His symptoms, however, point to a mild yellow fever. He had never had the disease, and was sick at no other time during the epidemic. He is a white man in the employ of the city stevedore; lived on the corner of Indian Street Lane and Joachim Street, in the heart of the Indian Street district. The case may not have been a case of yellow fever, but his case certainly has claims for recognition as strong as many which have been so accepted.

During the progress of these cases in the Indian Street focus, several isolated cases of yellow fever occurred in the western district of the city, which must be individually considered in order to arrive at any correct solution of the problem of the epidemic diffusion.

On the 13th of August, two of these cases are reported to have occurred. One in the person of a woman named Lydia Williams, and the other in the person of the Rev. Mr. Cafferty, the pastor of St. Patrick's Church.

Lydia Williams (3) was taken sick at her home on William Street, near Farm Street, with what was considered a severe remittent fever, but which is now believed to have been yellow fever.

"Maggie Harrison, who lived in the house with Lydia Williams, who nursed her during her last illness, states that the latter had been suffering from chills and fever for several weeks before her death, but that she was taken with yellow fever, of which she died on the 14th of August. Her symptoms were headache, both on the top of her head and the forehead, sick stomach and vomiting, eyes yellow, color of the skin yellow, and she vomited a quantity of black vomit. Maggie Harrison states that she knows positively that Lydia Williams visited the northeastern sections of the city a few days before her last illness."[1]

Lydia Williams was an exceedingly poor woman, who subsisted upon such alms as she could obtain. She was accustomed to tramp over the city, and it is now impossible to trace her routes beyond that which has been noted by Dr. Duncan. The fact that she is known to have been in the eastern focus of the disease, places her case in the same category as other cases infected in that locality.

The Rev. Mr. Cafferty (4), then the pastor of St. Patrick's Church, whose residence was in rear of the church, on the northeast corner of West Broad and Stone Streets, was taken ill on August 13, with that which is now believed to have been yellow fever.

Surgeon Woodhull, who has made an elaborate study of this case, is unable to trace any connection between it and any previous case or cases. He, however, shows that this gentleman was exposed under his own roof to the poisonous exhalations of a dry well, which was used as the cesspool of the premises, and that by driving on the Thunderbolt Road he was exposed to the effluvium of Bilbo Canal.

It can scarcely be asserted that the Rev. Mr. Cafferty, in the exercise of

[1] From a note of Dr. William Duncan.

his sacerdotal functions, did not come in contact with any one infected with the poison, for it is well known that the priest of a large parish of necessity visits and is visited by numbers of individuals, many of whom may be utterly unknown to him, and who are from all classes of society; but we do not consider it necessary to indulge in any such speculations, for it is more than probable that Mr. Cafferty, while suffering from the septic emanations of the cesspool, was infected with yellow fever, when driving on the Thunderbolt Road, in the vicinity of Bilbo Canal.

We consider the case of the Rev. Mr. Cafferty as but a link in the chain of epidemic diffusion. Had he been confined to his house during the preceding thirteen days of August by either sickness or a season of religious retreat, were it not known that he had crossed Bilbo Canal at its most offensive point, or had his illness been sufficiently pronounced to have enabled his physician to make an early diagnosis, then we might have been forced to acknowledge it a case of isolated yellow fever. The contrary is, however, the case. Mr. Cafferty attended to all his duties up to August 13. It is stated "that his symptoms tally exactly with those of severe yellow fever, up to, but not reaching, the stage of black vomit." At the time he was taken ill, there was no recognition of the disease in the city, and it was not until he had been ill eight days that the fact that Savannah was infected with yellow fever was known. The case of Schull had been considered as sporadic; the cases of Thomas Cleary and James McCarty had not come to light. Mr. Cafferty was attended by one of the most accomplished medical men of the city, the same who reports the three June cases, yet he did not recognize the case as one of yellow fever until the epidemic was established. When the epidemic influence was pronounced, then Mr. Cafferty was said to have yellow fever; had no epidemic occurred it would probably have been recorded as of malarial origin.

On the 20th of August, a German girl (6), who was employed in a bakery at the corner of West Broad and William Streets, was attacked with what is now recognized as yellow fever. Before her sickness she had visited some friends who lived in the eastern focus, and at no great distance from the Cleary house. The same day a young child (7), whose parents resided on Jefferson Street, near Perry, was taken ill on board of a steamer en route for Philadelphia, Penn., with what is supposed to have been yellow fever. The child was carried to Philadelphia, is represented as having been very ill, but recovered. She was but six years of age, and it is not known that she had been in any infected locality; but as the children of even the most watchful parents are at times (of necessity) committed to the charge of servants, it would be unwise to insist that this little one could not have come in contact with any infected person.

Within a square of the house of this child's parents, the Inspector of Dry Culture resided. This man was required to visit the low lands about the city. It is well known that in August he was engaged in an official controversy, which assumed an excited and angry phase, as regards the general sanitary condition of the surroundings of the city, and especially as to the condition of Bilbo Canal. It is known that he frequently visited that particular locality, and that he made his complaints to all influential citizens, one of the most prominent being the father of this child. One week later, the wife of the Dry Culture Inspector was taken with yellow fever, of which she died September 1. These facts are noted as showing that the case of this young child cannot be considered isolated as regards its exciting cause.

On the 21st of August, Herman Cohen, who lived on Perry Street, east of West Broad Street, was taken with yellow fever, and died September 2. The connection of this man with any known focus cannot now be traced. He was a butcher by trade, and it is quite as reasonable to suppose that he had been in some infected district, as to assume that he had not. His house was within a short distance of the residence of the Dry Culture Inspector.

Of these five isolated cases it must be remembered that but one was recognized at the time of its occurrence as being yellow fever, — the case of Herman Cohen, who was taken ill on the day that James Patrick Cleary died. Lydia Williams was buried on a certificate of death from remittent fever,[1] and the other three cases were only pronounced yellow fever after the epidemic outbreak. Three of these cases did not establish foci — Lydia Williams, the German girl, and the young child. The latter having been taken ill at sea, and not returning to Savannah until after the close of the epidemic, certainly could have contributed nothing to the general result. The cases, however, of the Rev. Mr. Cafferty, and of Herman Cohen, must be considered as the initial cases of the Stone Street and the Perry Street groups.

On the 24th of August, a Mrs. Malcomes, who lived on Stone Street immediately in the rear of Rev. Mr. Cafferty's house, was taken with yellow fever, and died on the 28th. Several other cases, two of which were fatal, occurred in this house within a few days.

On the 25th of August, in the immediate vicinity of the Malcomes house, a case occurred which terminated fatally. On the 26th four cases occurred, two of which were fatal, one being the husband of the case of the 25th, and on the 27th another fatal case occurred.

These are the initial cases in the Stone Street group.

On the 23d of August, a lady living at the corner of Perry and Montgomery Streets, at a short distance from the house of Herman Cohen and opposite the house of the Dry Culture Inspector, was taken with yellow fever. She recovered, but nine cases of the disease occurred in rapid succession in the same house.

On the 24th of August, a young boy living on Montgomery Street, opposite the last case, was taken with yellow fever, and eight cases of the same disease occurred in the house within five days.

On the 27th of August, the disease appeared in the house of the Inspector of Dry Culture.

On the 28th of August, a family living on Liberty Street, east of Montgomery Street, were infected and several cases occurred. These are the

[1] Mortuary list published by the *Savannah Morning News*, November 28, 1876.

initial cases of the Stone Street group, to which, undoubtedly, belongs the case of the boy who was taken with yellow fever at his house on State Street, between Whitaker and Barnard Streets, on the 24th of August, and who died on the 28th. It has been shown that he was in the habit of frequenting the locality in which these cases occurred. It is demonstrated by this narrative that a common origin existed for all the foci of yellow fever infection in the city of Savannah in 1876, and that is the yellow-fever-infected air contained in the holds of the Spanish vessels that entered that port during the months of July, August, and September, 1876, and which was also an important constituent of the ballast discharged from those vessels.

The seaman Schull, and the boys Thomas Cleary, James McCarty, George Bussell, Bill Ray, George Lapin, and John Conners, were the first who yielded to the morbific influences, and by each a focus for the diffusion of the disease was established.

These seven individuals could only have been infected in the port of Savannah. Schull had been the steward of the *Sewer* for fourteen months, and, as that vessel sailed under a coastwise license, there is no possibility of her having visited any infected port. None of the boys who have been named belonged to a class of the community whose means allowed them to be absent from their homes.

The city of Brunswick is built upon a sandy plateau, which is almost entirely surrounded by sea water. South River on one side, and St. Simon's Sound with its inlets on the other, flood the salt marshes at every influx of the tide. The nearest rice plantations are twelve miles distant, and a heavy growth of timber is interposed between them and the town. The plateau is covered with live oak, palmetto, and cedars. The mean temperature of the locality is 67° F., while the thermometer seldom rises to 94° or falls below 30.° Pure water is obtained by digging through a stratum of fine sand, covered by a hard pan, which underlies the whole section of the country.

The surroundings of this town are perfectly indicated by the map, used as an illustration.

In this town no possible local causes of disease can be found. The population numbers about twenty-five hundred individuals, who are scattered over the plateaux. It is laid out as a city of magnificent distances; no crowding exists. There are no large privy vaults or cesspools filled with excrementitious matter, no heaps of garbage or other débris in which decomposing organic matter exists, by which the water and the air could be polluted.

The town is the terminus of the Macon and Brunswick, and the Albany and Brunswick railroads. Its harbor presents many advantages, as vessels drawing twenty-four feet can be brought over the bar and up to the railroad wharves at any flood tide. The exports are chiefly cotton and lumber.

Before 1876, yellow fever was unknown at Brunswick. It seemed a legend among the inhabitants that the disease could not spread in that locality; but in 1876, without warning of any character the explosion occurred, and the town was ravaged.

This epidemic outbreak was not in the heart of this little city or among its inhabitants, but the epidemic in its inception was confined to the crews of certain vessels, and to individuals who had been in constant contact with them; we shall, therefore, confine our attention to the points so clearly indicated. Prior to the epidemic there were in the harbor of Brunswick the following vessels: —

I. The Spanish bark *Marietta*, from Havana.

II. The American schooner *Wm. H. Boardman*, from Castries, St. Lucia.

III. The American schooner *Ed. Johnson*, from New York.

IV. The American schooner *M. M. Pote*, from New York.

V. The American schooner *Winner*, from St. Thomas.

The histories of these vessels are as follows: —

I. The Spanish bark *Marietta* arrived at Brunswick August 1, eight days out from Havana, with a crew of fourteen men. Her bill of health, dated Havana, July 19, 1876, states: Yellow fever prevails in the city and port. The *Marietta* came in ballast, for a cargo. No disease occurred on her during the voyage; but before she left Havana, her crew was attacked with yellow fever, a number died, the remainder were sent to hospital, and she was manned by convalescents from the same institution.[1]

These facts are authentic, and have already been made public by the Georgia State Board of Health.

The ballast from the *Marietta* was examined by the health officer, and was found to be composed of "dirt, palmetto leaves, rags, and rubbish of all kinds." This ballast was discharged opposite the centre of the town.

II. The American schooner *Wm. H. Boardman* arrived at Brunswick August 9, fourteen days out from Castries, St. Lucia, with a crew of six men. She came in mixed ballast for a cargo. No sickness occurred on this vessel during the voyage, and no suspicion of infection can be traced to her prior to her arrival at Brunswick.

III. and IV. The American schooners *Johnson* and *Pote* were under coastwise license only. No record of them was made in the custom house, but they were both from a healthy port, and were presumably clear of infection of yellow fever prior to their arrival at Brunswick.

V. The American schooner *Winner* arrived at Brunswick August 17, twelve days out from St. Thomas, with a crew of six men. She came in mixed ballast and for a cargo. She had a clean bill of health, and no suspicion of infection fell upon her, before, during, or after the epidemic.

The *Marietta*, the *Boardman*, the *Johnson*, and the *Pote* lay at the wharves, in close proximity to each other.

There was no sickness of any unusual character at Brunswick until the 20th of August, when Dr. J. S. Blain was called to see the steward of the *Boardman*, whom he found to be ill with yellow fever. The captain of the *Boardman* remarked to Dr. Blain that he had another sick man on board, "but that he was all right." The next day (August 21) the man who was "all right" died. August 22, the *Boardman* cleared for New York.

[1] Statement of the captain of the *Marietta* to the collector and health officer of the port of Brunswick.

The steward was still ill on board, and is reported to have died at sea, as did also a man named Robert Palmer, who had shipped at Brunswick, while a third man was taken with yellow fever and recovered at the Quarantine Hospital, New York harbor.

The *Boardman* and the *Marietta* lay side by side.

While the body of the man who died on the *Boardman* August 21 was on the deck of that vessel the captain of the schooner *Johnson* came on board to visit the captain, and remained on board for a considerable time. The next day, August 22, he was taken ill, was removed from his vessel to the city hotel, where he died of yellow fever on the 24th, and several other cases of the disease occurred upon his vessel.

The occurrence of these cases recalled attention to a case which had already occurred in the town, but which had excited no suspicion as to its true character.

On the 13th of August a man named Hertzog had been taken ill and had died on the 17th of the same month. It was evident, when his case was considered by the light of the succeeding cases, that he had died of yellow fever. Hertzog was a butcher. He supplied meat to vessels in the port; and with Messrs. Toate, Zeigler, Beitzer, and Doerflinger, was upon terms of intimacy with the captain of the *Marietta.* They had visited and frequently dined on board of the Spanish vessel. On September 2, Zeigler and Toate were sick with yellow fever. Zeigler died on the 7th and Toate on the 9th. September 4, Beitzer and Doerflinger were down with the same disease, but both recovered.

On the 20th of August a poor woman named West went on board the *Johnson* and was given several suits of woolen clothes to repair. Mrs. West returned the clothing September 2; the next day (September 3) she was ill of yellow fever, of which she died September 7.

On the 3d of September the mate of the schooner *Pote* was taken with yellow fever, of which he died the next day (September 4). This case was followed by the illness of the captain, steward, and two seamen of the same vessel, but all recovered.

From these cases the disease was carried into the town. Dr. J. S. Blain,[1] the health officer, reports "that yellow fever prevailed on the vessels in port for twelve or fifteen days before the disease made its appearance among the residents. That the town was perfectly healthy up to the outbreak of the epidemic, and that the disease progressed against a strong northeast wind that prevailed during the whole of the epidemic. That absolutely there were no malarial influences affecting the town nearer than the rice-fields twelve miles off;" but it is also stated that "after the prevalence of a northeast wind it is customary to find malarial fever in the town."

The last clause of this statement may be considered by some who view this subject from the malarial standpoint alone as a saving clause in the epidemic history. Malarial fevers did occur in Brunswick after the prevalence of a northeast wind. A wind from the northeast did prevail during the entire epidemic, therefore the cause of the disease must have been blown from the rice-swamps twelve miles distant.

[1] *Report of the Georgia State Board of Health,* 1876, Appendix, p. 54.

But if such reasoning be true, a curious circumstance interrupts the chain of logic. The northeast wind blew over the town of Brunswick and expended its force upon the vessels in the harbor. Upon these vessels, and among those having connection with these vessels, sixteen cases of yellow fever occurred before the epidemic influence was felt in the town.

The vessels in port were the foci from which the epidemic fire originated, and there can exist no reasonable doubt that it was occasioned by the specific poison of yellow fever distributed from the *Marietta*.

Doboy is a small island at the mouth of the Altamaha River. It is entirely surrounded by salt water, and, having a good harbor, is used as the port of the town of Darien.

The island is very small and low, its greatest elevation being about ten feet above the sea level. Its inhabitants number about one hundred and fifty, the majority of whom are negroes. The principal export is lumber, furnished from a large saw-mill upon the island. The inhabitants depend upon the main land for their supplies; even water for domestic uses has to be transported.

In 1876 a virulent epidemic of yellow fever occurred upon this island, the facts connected with which may be briefly stated as follows: —

On the 19th of August the Spanish bark *Valentina*, eleven days out from Havana, arrived at Brunswick. She had a crew of eleven men, was in mixed ballast, and was seeking cargo. Immediately on reaching Brunswick the *Valentina* was chartered for Doboy, and she sailed for her destination without any of her crew going on shore, except the captain.

The *Valentina* reached Doboy August 27. She commenced discharging her ballast at the mill wharf on the 28th or 29th, and cleared with her cargo September 16.

The first case of yellow fever on Doboy was in the person of the superintendent of the Doboy saw-mill, who went into the hold of the *Valentina* to ascertain her carrying capacity as soon as the ballast was removed. This man was severely attacked, but recovered.

The second case was in the person of the man who had general supervision of the wharves of the saw-mill company, and who also discharged ballast. He was constantly about the *Valentina*. He was taken with yellow fever September 4, and died on the 20th.

The third case was in the person of the pilot who had carried the *Valentina* from Brunswick to Doboy. He recovered.

The disease then spread among the negroes who lived around the spot where the ballast from the *Valentina* was deposited, and from these cases the epidemic influence spread.

On the 11th of October, twenty-six days after the *Valentina* cleared from Doboy, the American schooner *Ralph Howes*, of Boston, arrived at Doboy. A few days after her arrival, her captain was taken with yellow fever, of which he died; and several of her crew had the disease and recovered.

These facts have been obtained through the kindness of Mr. E. C. Davis and Dr. Spalding Kenan of Darien, Dr. James S. Blain of Brunswick, and Colonel Jno. T. Collins, Collector of Customs of the last named port.

They clearly indicate that the disease was introduced upon Doboy Island from the bark *Valentina*.

A contrary statement has, however, been made, which attributes the epidemic to entirely local causes.[1]

The gentleman who makes the report states, when referring to a visit which, in connection with the Board of Health of Darien, he made to the island, "The whole northern margin of the island was a mass of impurity, and a portion of the Board of Health, who visited the island with me to ascertain the cause of the fever, were at once satisfied by their olfactories out of doors and their investigations within, of the immediate local and abundant source of the existing disease."

This report further states "that there had been no communication with either Savannah or Brunswick, or other infected ports. The shipping season was over, and but one vessel in port, and she nearly ready for sea. One of the first cases was her captain, who died after a short illness." It is very evident that the gentleman making this report collected his facts upon the "junketing excursion from Darien," of which the residents of Doboy write so bitterly.[2]

Although the city of Darien was not visited by yellow fever in epidemic form during the year 1876, still, from its location and from the fact that several deaths occurred in that town among parties who had contracted the disease on Doboy, it is necessarily included in this history.

Darien is a town of less than one thousand inhabitants, situated on the east bank of the Altamaha River, about twelve miles from its mouth. The town is built upon a bluff of about thirty feet in height. It is almost surrounded by rice fields and low swamp lands. The rice fields are to the north, south, and west of the town.

In his report to the Georgia State Board of Health, Dr. Spalding Kenan remarked "that for seven or eight years after the late war these rice fields were not cultivated, and that the intermittent and remittent fever were of a mild type. The inhabitants were able to reside in the town during the entire year, which they were unable to do before the war, when the rice fields were in general cultivation. For the past three years these rice fields have been gradually brought back under cultivation, and the prevailing summer and fall sickness has not only increased in the number of cases, but in their gravity. We suffer more from this malarial influence at the close of the summer, and during the fall months, on account of the withdrawal of the harvest flow from the rice fields and the drying up of the swamps."

Darien has no harbor upon the river, therefore the island of Doboy, at the mouth of the river, has been selected for that purpose. It is a distance of twelve miles from the town to the island, but communication by means of steam and sail boats is constant, and many individuals doing business on Doboy live in Darien.

In 1876 but very few cases of yellow fever occurred in the town of Darien, and they were all among persons who contracted the disease on Doboy.

[1] *Report of the Georgia State Board of Health*, 1876, Appendix, p. 47.
[2] *Ibid.*, p. 53.

Two of these cases died. It has been impossible to arrive at the exact number of cases which occurred; they were, however, probably not more than six or eight. The first fatal case was in the person of Dr. J. B. L. Baker, at that time health officer of Darien. He had been constantly on Doboy, where he contracted yellow fever, of which he died September 26. The second (and last) fatal case was in the person of a young lady who returned from a visit to the north via Doboy. She died November 7. The escape of this town from the epidemic influence is undoubtedly due to the strict sanitary measures which were enforced. The town was guarded closely by night as well as during the day, and particular attention was paid to the cleanliness of privies, backyards, and all outhouses.

The Isle of Hope is ten miles southeast of Savannah, with which city it is in constant railroad communication. This locality is an inland section of Chatham County, which is surrounded by the waters of the Vernon and Wilmington rivers. It has always been considered a place of refuge during seasons of epidemic influence; and Dr. S. F. Dupont states that in 1876 at least three thousand individuals were added to its population. The first case of yellow fever which occurred in this locality in 1876 was in the person of a man named De Gauge, a refugee from Savannah. This man slept on the island, but spent each day in the city. He died about the 22d of September. The second case was in the person of a man named Grover, also a refugee from Savannah, who only slept on the island. He died on the 23d of September.

When it was ascertained that Grover was sick, he was removed to a small outhouse, and after his death the bed-clothing was taken out in front of the house and burned. At this moment Mrs. Beckett and her child were looking out of an open window watching the burning. The cook of this lady was also looking out of an open window of the kitchen. A gust of wind carried the smoke of the burning clothes across the intervening space, and full into the faces of these three individuals. In three days Mrs. Beckett, her child, and the cook all were down with yellow fever, but all recovered. The occurrence of these three cases connected with the burning of the bed-clothing used by the dead Grover, may have been but a simple coincidence: but, in the Beckett house lived a family of ten individuals, all of whom had been exposed to the same influences, saving the smoke, yet only those who inhaled the smoke of the burning bed-clothes took the disease. For these facts we are indebted to Dr. George H. Stone of Savannah.

At the Henderson house a sick child was brought from Savannah. It had yellow fever, and as soon as it was discovered was at once carried back to town; but the short time that the child was in the house was sufficient to infect the premises, and several other cases occurred. From these cases the disease spread and many fatal cases occurred. Opposite the Isle of Hope, and at but a comparatively short distance from the houses in which the epidemic influence was most strongly exhibited, is the celebrated Bethesda School, at one time so dear to the heart of John Wesley. At this point a considerable number of persons were congregated, but no case of the disease occurred. Communication with Savannah was, however, very much less frequent than was the case on the Isle of Hope.

During the epidemic in Savannah, a most interesting case occurred at Oliver Station, section No. 4½, on the Georgia Central Railroad, which fully demonstrates the active agency of common carriers in the diffusion of contagious diseases. For the accommodation of the Central Railroad employees and the citizens of Savannah during the epidemic a daily train was run to this station, which is some forty odd miles from the city. The train remained at Oliver over night and returned to the city in the morning.

On the night of September 10, a man named Lufburrow slept on board this train, and on the 16th was suddenly taken with yellow fever, of which he died on the 21st. This man had not been to the city, and the only contact which he had with the contagium was on the night he slept in the cars.[1]

Two cases of the disease occurred among some United States troops who were encamped at this point, having evacuated their barracks in Savannah on account of the epidemic, but no other cases occurred in the locality.

Augusta is situated on the west bank of the Savannah River at the head of steamboat navigation, and about one hundred and thirty miles from its mouth. The city is in direct railroad communication with Savannah, Port Royal, and Charleston; and being the shipping point for a future agricultural district, as well as holding large manufacturing establishments, its carrying interests are very large. At this city in 1876 an "aborted epidemic" of yellow fever occurred; four deaths are reported with a total number of about twenty cases. These all occurred among persons who lived in the vicinity of the railroad freight depots and car yards; and it has been clearly shown by Dr. H. F. Campbell that it is attributable to the influence of the atmosphere of Savannah which was imported in railroad cars.[2]

Macon, one of the principal cities of the State of Georgia, is built upon both banks of the Ocmulgee River, but above the head of navigation. The city has, however, extensive railroad connections with all points, and is the terminus of direct lines from Savannah and Brunswick. A very considerable amount of cotton and other produce is shipped from this point. It has been found quite difficult to obtain a correct outline of the epidemic of 1876 at this point, but when shorn of all personal opinions, the following is believed to be a correct outline of the events which occurred: —

Early in October two cases of yellow fever occurred in the persons of employees of the Macon cotton factory. It is learned that at the residences of these persons were several refugees from Savannah. Both of these two first cases died with black vomit. After these deaths occurred the refugees removed to other portions of the city, where they were subsequently taken with the disease, and in one instance a fatal case again occurred from their contact. During the prevalence of this slight epidemic, the greatest number of cases occurred on the two blocks between Fourth and Fifth Streets, and Pine and Oglethorpe Streets, immediately in front of the Southwestern Railroad depot, at which all freight from Savannah was received and delivered. A few cases occurred in the vicinity of the Macon and Brunswick

[1] Statement of Dr. A. B. Lanier. *Report of the Georgia State Board of Health*, 1876, Appendix, p. 51.

[2] *Report of the Georgia State Board of Health*, 1876, pp. 132–152.

Railroad depots, and some other cases occurred scattered along the railroad tracks.

Dr. T. W. Mason, the city physician of Macon, writes me that he is strongly of opinion that the diffusion of the disease was influenced by the fact that box cars were carried to Savannah from Macon, filled with freight, closed, and not opened until they again reached Macon ; and he illustrates this by the occurrence of two cases in the family of a man who was receiving crates of cabbage and other vegetables from Savannah. Both cases occurred in persons who received the vegetables from the railroad company. Several fatal cases occurred among refugees from Savannah and Brunswick, who lodged in various portions of the city. In one instance several cases followed, but the disease did not spread to other families. The disease was diffused only in the portions of the city which were adjacent to the railroad depots.

The few cases of yellow fever which occurred at Atlanta are possessed of no interest. They were all among refugees from Savannah. No resident of Atlanta became subject to the influence.

The point of greatest interest to the practical sanitarian in this study is the causation of the epidemic. Is it possible to assign the cause, or to account for the outbreak? It could have resulted from but one of two sources. It (the epidemic influence) must either have been carried from some previously infected locality, by human agency, to the coast of Georgia, or it must have originated from a combination of certain atmospheric and telluric causes.

Yellow fever possesses certain characteristics, which belong to itself alone. It is governed by certain known laws, which increase its power, or which cause its destruction; and it is therefore but just to claim that the specific cause of this specific disease must be specifically the same in every district in which it may assume epidemic power. That is, if malaria is a true and efficient cause of yellow fever, then we should expect to obtain that cause in every infected locality. If septic emanations from decomposing organic matter be the cause, we may then expect to detect that cause in all infected localities ; but if such agents are not always to be found we should discard them in favor of a factor ever present, if such factor may be found.

It is desirable to prove the epidemic of 1876 by this rule.

Six distinct localities were subjected to the epidemic influence. Four were upon the sea-coast. Two were at a considerable distance inland. At the four localities upon the sea-coast, Savannah, the Isle of Hope, Doboy Island, and Brunswick, the greatest diversity of sanitary conditions existed. The local condition of Savannah was bad, the intra-mural causes of disease were abundant, and the city was surrounded by a country teeming with malaria. The prevailing diseases of the city were of miasmatic origin. The local condition of Brunswick was most satisfactory, no intra-mural causes of disease existed, the city was not exposed to malarial influences, and there were no prevailing diseases.

In these two communities, more than one hundred miles apart, and living under such divergent influences, yellow fever was developed almost simultaneously, and it is most evident that if the epidemic was occasioned by local causes, then there must be one cause for yellow fever in Savannah, and another cause for yellow fever in Brunswick, and thus there could be no identity. But the demonstration was of malignant yellow fever, the disease exhibited the same characteristics in both cities, and if any difference could be observed it was that the type of the disease was graver in the city which had the best sanitary record.

Doboy Island presents a series of diverse local conditions. It is a small, low island, entirely surrounded by salt water, and upon which the chief difficulty of the inhabitants consists in obtaining soft water for domestic use. It is true that upon Doboy the huts occupied by the negroes may have been in a filthy condition, but it was no worse than that in which such dwellings are almost always found, and the disease did not originate among that class of the residents, but among those who were "well to do." Doboy has never been an unhealthy locality, yet its inhabitants were called upon to bear the brunt of an explosion of yellow fever, while the town of Darien, only twelve miles distant, and in the midst of a notoriously miasmatic district, escaped. There is not the least similarity between the local causes for disease on Doboy Island and those which existed at both Savannah and Brunswick, and yet Doboy had the same yellow fever.

The Isle of Hope presents another aspect of local affairs. It is a rural district, with a scattered population, in the very heart of the swamp lands of Eastern Georgia. The atmosphere is full of malaria, and certain localities of this district have been noted for deadly fevers, while others have always been considered as salubrious. This district suffered severely from the epidemic. The one local condition which it had in common with Savannah was an atmosphere laden with malaria, but in every respect its local conditions were different from Brunswick and Doboy, yet the Isle of Hope had the same yellow fever that the other three localities had.

Adjoining the Isle of Hope, and subjected to the same local influences, is Bethesda. If the Isle of Hope had in common with Savannah any atmospheric or telluric causes which produce yellow fever, Bethesda had precisely the same, and yet Bethesda had no yellow fever, although the Isle of Hope was ravaged.

The cities of Augusta and Macon again present local conditions which have the malarial element alone in common with Savannah and the Isle of Hope ; but that factor of disease exists in a modified form. They have absolutely nothing in common with Brunswick and Doboy, and they are absolutely free from the intra-mural causes of Savannah. Brunswick, Doboy, the Isle of Hope, Augusta, and Macon were all free from the septic emanations which undoubtedly polluted the air and water of Savannah. Yet they all had yellow fever.

Savannah was, prior to the outbreak, in a miserable sanitary condition. Measures for the protection of the public health were either utterly neglected or performed in the most slovenly manner. All the other localities were in good sanitary condition ; yet they all had yellow fever. Savannah and the Isle of Hope were subjected to profound malarial influences ; Augusta and

Macon were influenced by malaria in a modified form. Brunswick and Doboy had no malaria; yet they all had yellow fever.

It is therefore evident that if the source of the yellow fever is to be looked for only in local causes, and all else is to be rejected, there must have been one special cause for Savannah, another for Brunswick, another for the Isle of Hope, another for Doboy, another for Augusta, and another for Macon; or else there must have been a different type of the disease for each locality.

If, on the other hand, we view this history from the stand-point of the diffusion of infectious diseases by human agency, we shall see that Augusta, Macon, the Isle of Hope, Doboy, Brunswick, and Savannah had a common factor of disease, which will satisfactorily account for all that which occurred.

The theory which I advance is both simple and practical. It is that the city of Savannah was infected by the yellow-fever-poisoned air discharged from the holds of the Spanish vessels *Ynes* and *Maria*. That to this infection G. W. Schull, Thomas Cleary, James McCarty, George Bussel, Bill Ray, George Lapin, and John Conners were the first victims. That from the autopsy on the body of Schull the Bilbo Canal was infected, and that from the infection thus obtained, the cases of Richard Grandison and others originated.

That Brunswick was infected by the Havana atmosphere contained in the hold of the Spanish vessel *Marietta*, and that the individuals who visited that vessel, and the crews of vessels lying in her immediate vicinity, were the first victims.

That Doboy was infected from the Havana air contained in the hold of the *Valentina*, and that the pilot who brought that vessel from Brunswick, and the superintendents of the saw-mill and wharves, were the first victims.

That the epidemic on the Isle of Hope, at Augusta, and at Macon, and the case at Oliver Station, originated from the infected air of the city of Savannah, which was carried out in railroad cars, and discharged at each point which subsequently became infected.

Although we have as yet no positive evidence as to the methods by which yellow fever is diffused, still it is generally considered to be an acute infectious disease, caused by a specific malignant poison which multiplies itself by its passage through the human system, and reproduces the same specific true yellow fever; that the specific contagium may be reproduced with great rapidity in places where decomposing organic matter abounds; that the specific contagium may be rapidly reproduced in an atmosphere impregnated with the emanations from animal and vegetable matter in a state of decomposition; and that influenced by certain personal, meteorological, and telluric causes, the disease may be diffused by the migrations of individuals, and the transportation of fabrics or volumes of atmosphere from infected localities, while the porter may himself escape the infection.

To those who accept as true these propositions, the argument which has been advanced will be received as having a greater weight than a mere hypothesis, it will be received as an established theory. To those, however, who hold that the causation of yellow fever is confined to certain unexplained atmospheric conditions, combined with great heat and moisture, and who deny that any specific infection influences the diffusion of the disease, this argument will be but a mere hypothesis.

But if the theory which we have advanced is true, and we claim that the evidence presented demonstrates its truth, it offers a solution to the problem, which the other can never give.

The theory which I advocate is practical, and may be acted upon for the benefit of all whose lives and interests are involved. It offers a means of escape from the evil to come, while the other hypothesis takes away all hope; for what can human agency effect against that which the human mind cannot comprehend?

It has been asserted that if the specific poison of yellow fever which caused the epidemic in question was imported, no system of quarantine could have guarded against it.

To this assertion the theory which I have advanced gives an unqualified denial. I am, from the facts which I have collected, absolutely convinced that had the same system of quarantine regulations been in force upon the coast of Georgia in 1876, as was established by the late Board of Health for the State of Louisiana, at the Mississippi River quarantine station, the epidemic of 1876 would have had no existence.

FORT LAPWAI, IDAHO, *December*, 1877.

XVIII.

VIEWS ON THE SUBJECT OF PREVENTION OF YELLOW FEVER.

By WILLIAM SELDEN, M. D.,
Of Norfolk, Va.

READ AT THE ANNUAL MEETING, RICHMOND, VA., NOVEMBER 20, 1878.

I do not propose to occupy the time of the Association with a discussion of this question, which has been debated with great acrimony and in a partisan spirit, by no means creditable to the medical profession, during the latter part of the last and the early years of the present century. It now seems to be settled, or very nearly so. I think I am correct in asserting that an overwhelming majority of the profession believe that the disease is not indigenous in any part of the United States, unless, perhaps, in the semi-tropical climate of our Gulf coast, in regard to which there may be some doubt.

I will only state the result of my observation and study of the epidemics which have visited the city of Norfolk during the last sixty years. Since 1805 the disease has been epidemic four times, namely: in 1821, 1826, 1852, and 1855. In regard to three of these epidemics, namely, those of 1821, 1852, and 1855, the evidence that the disease was introduced from abroad is very strong, and, to my mind, conclusive. Of the epidemic of 1826 there is no published account, even the newspapers of the day being silent on the subject, for fear, I suppose, of injuring the trade of the town. The great epidemic of 1855 was thoroughly and faithfully investigated by a committee of physicians, of whom I was one. The labor occupied us many months. The evidence was complete, and the opinion of the committee unanimous, that the disease was introduced into our port by the steamer *Ben Franklin*, from St. Thomas, where it prevailed, at the time of her departure from that port, in a most malignant form. For the evidence upon which our opinion was based, I beg to refer to the report of the committee, which was published in pamphlet form, and widely distributed, and also in the June or July (1857) number of the "Stethoscope," a medical journal published in Richmond. If I am correct in my opinion that the disease is imported, then it can be kept out by a proper quarantine, rigidly enforced. If, on the other hand, it be of local origin, it is manifest that quarantine is useless and unnecessary, and ought to be abandoned.

In regard to the mode of its introduction there is a difference of opinion. Some physicians — very few, I think, among those who have seen much of the disease — believe that it is contagious, and communicated by the person of the sick to the well. A majority — a very large one, I believe — think that the disease is not contagious, never communicated by persons, but that the seeds or organic germs causing the disease are of tropical growth, and transported in the holds of vessels to places out of the tropics, but where the summer heat is sufficient for the growth and increase of the morbific germs. This latter is my opinion, based upon long study and observation. If the disease be introduced from abroad, as I think is clear, and if it be not contagious, of which I feel very sure, at least as regards this latitude, I can conceive of no other possible means of the importation; if the poison be not in the blood of the person, it must be in the hold of the ship.

No place in the United States has afforded a better opportunity than Norfolk of proving that the disease is not contagious. Being a naval station, and the nearest to the Gulf, it has been for the last sixty years, and probably longer, the resort of our ships of war with yellow fever on board. Thirty or forty years ago, before our officers had learned how to guard their ships from the disease, very few indeed of our vessels cruising in the Gulf escaped an outbreak of the fever. Whenever the disease existed on shipboard to any serious extent the vessels came north, and usually to this port. On their arrival their uniform practice was to anchor the ship about two miles from the town, and to send the sick at once to the United States Hospital, in the harbor. The sick men were placed in the same ward with other patients, no separation being attempted; no disinfectants used, for none were then believed to exist. They were visited by the surgeons, and waited upon by nurses, and yet during sixty years there has not been a single instance of any one, surgeon, nurse, patient, or visitor, taking the disease. In 1854 the French war steamer *La Chimera* lost in the hospital here seventeen, or about one quarter of her white crew, yet no one took the disease from them. In our great epidemic of 1855, thousands of our people fled; many of them too late, — perhaps some one hundred had the disease after their arrival at other places. They were placed in every variety of condition, — in the country and in town, — in hotels, in private houses, in hospitals. Some died, some got well. They were generally kindly received and cared for, and yet there was not a solitary case, that I ever heard of, of any one being even suspected of being made sick by waiting upon them. Am I not justified by these facts in believing that the disease is never contagious? The poison of yellow fever, in my view, is like the malarial poison causing intermittent fever. These poisons — organic germs, perhaps — are absorbed into the blood, and produce each its own peculiar disease, but the poison dies in the system of the patient, does not there live and grow and multiply, and consequently is not given off so as to communicate the disease to another. I would as soon expect a man with ague and fever to spread that disease in a healthy climate as a traveler, without his trunk, to give the yellow fever to others.

In the year 1848, the United States sloop of war *Vandalia* arrived at this port with yellow fever. I was then a member of the Board of Health, the only physician on it. I induced the board to allow the officers to come ashore; in a few days Captain Chauncey was taken sick with the fever at a hotel, and Lieutenant Poindexter, also, at the house of his father-in-law; they both recovered, and no one took the disease from them, nor was there any panic in the town.

As to yellow fever being ever produced by imperfect sewerage, upturned earth, or filling up with garbage, I am not prepared to speak, as regards other climates, but will leave the subject to the gentlemen from New Orleans and the other southern cities which have suffered so severely this last summer. I am sure that it never has been produced by such causes in this place. While willing to admit that a bad sanitary condition may favor the spread and growth of the disease when once introduced, and add greatly to its malignancy, yet I cannot believe that, out of the tropics or semi-tropics, it can originate it. I would as soon expect a fine crop of wheat to spring from a field spread with manure, but without any seed being sown, as yellow fever to originate from garbage, without the germs of the disease being scattered over it.

Entertaining the above views, I believe that the yellow fever can be kept out of our ports by a proper quarantine. I am in favor of a very rigid quarantine of vessels arriving from yellow fever ports, or even latitudes where yellow fever usually prevails; but I would make the quarantine of persons very light, merely detaining them long enough to wash and air their clothing.

Our present quarantine laws are very defective, owing in a great degree to the want of a clear understanding of the mode by which the disease may be introduced, and of the danger to be guarded against. The first great error is, that the health officer can tell by inspection whether there is fever poison on board a ship or not. If any one on board is sick with the fever, of course he will have no doubt, but at once order her to be detained; but if none of the crew be sick, how is he to tell that the ship is healthy? The crew, as is often the case with regular West India traders, may consist of acclimated men; or again, the poison may be in the ballast of the vessel, and so covered up by a closely stowed cargo that the infected air cannot escape, hermetically sealed as it were; such a vessel would, in most ports, be allowed to come up to the wharf and discharge; and as soon as the cargo is discharged and the ballast removed, the germs of disease, no longer confined, will at once get ashore, and may prove the starting-point of an epidemic. This, I believe, has frequently happened. The three epidemics of 1821, 1852, and 1855, in Norfolk, were clearly traced to vessels which, at the time of arrival, were not suspected to be a source of danger. The only way to guard against the danger is to detain all vessels from suspected ports, without regard to their apparent condition. I know of no test of the presence of yellow fever poison in a vessel's hold, save the exposure, for some days and nights, of unacclimated persons. This is clearly impracticable, and would be inhuman. I have no fear of the fever being introduced into our port by a vessel with cases of the disease on board at the time of her arrival at the quarantine station; my fear is of the vessels apparently healthy. Our present excellent quarantine officer, Dr. Nash, fully shares these views, and while he remains in charge I think we are as safe as any port can be. Another difficulty is in regard to the length of time that a vessel should be detained to render her safe; how long will yellow fever poison, in the hold of a ship, retain its vitality or activity? I know of no facts to decide this; the only safety, in my opinion, is in the detention of the ship until frost.

Another source of danger grows out of the idea, which seems to be entertained by many eminent men, that a vessel can be disinfected of yellow fever by carbolic acid, or other disinfectant. This may be so, but I think it remains to be proved; and we ought to have the experience of many years before we venture to risk the health of a large city, by reliance upon a theory which may or may not be correct. If there be a disinfectant, how is it possible to apply it effectually to a ship without first discharging her cargo and ballast? I am satisfied that it is altogether impracticable.

Absolute safety can only be obtained by the detention of all vessels from yellow fever latitudes arriving in warm weather, say from April 1 to May 15, according to climate, until frost; such a quarantine would make us absolutely safe; but it would amount to non-intercourse, and seriously interfere with, if it did not destroy, our West India trade. It would hardly be submitted to by a people so devoted to trade as we are. But this plan might be modified so as to interfere very little with trade and yet be very effective.

Let there be near every city engaged in West India trade, a station at a safe distance, say ten to twenty miles, where vessels might discharge their cargoes into warehouses or sheds erected for that purpose, and be loaded again with return cargoes, sent down to them in barges. Around these stations would soon grow small villages inhabited by stevedores, laborers, washwomen, etc.; these persons would be mostly acclimated, or soon become so. If, occasionally, the fever should break out in the village, it could do but little mischief, and could hardly spread to the city. This plan would cause but little inconvenience to trade, and would not be costly; half a cent addition to the price of sugar would probably cover the extra cost. This very year a large steamer from Cuba was loaded with cotton in this way in Hampton Roads, by barges, and I was informed that the additional cost of loading her was but a few cents per bale.

Another question submitted to your deliberation, is of equal importance to that of the protection of our seaports by quarantine. I allude to the prevention of the spread of the disease from town to town, if, in spite of our care, it should get a foothold in a seaport. It appears to have followed, this year, in the line of travel, by steamboat and railway. Whether transported in the cars, or spread by the travelers in the cars falling sick on their arrival at their destination, is the question to be determined by the committee appointed by the Surgeon-general of the Commercial Marine, and specially charged with the investigation of this point. I await their report, with great expectation of its value, but yet not without anxiety and fear, that they may be so overwhelmed by the great mass of testimony which will meet them at every point, from nonprofessional and ignorant people not yet recovered from their late panic, as to pronounce in favor of the doctrine of contagion

I hope that they will not report until they have gone to every place visited by the fever, patiently collected the best testimony within their reach, and carefully compared and analyzed it. It is better to make no report than an imperfect one.

While awaiting the report of this committee I would suggest that if the disease is carried by the cars, whose cushions and curtains are filled with the germs of the fever, and not in the blood of the travelers, who are about to have the disease, a very simple mode of conveying passengers might be adopted, which I think would prove effectual in preventing the spread of the disease along the line of travel, whether by river or railway. Let the cars from the infected city take travelers to a station ten or fifteen miles off, and there let the passengers be transferred to other cars and carried to their destination. Freight cars which are filled and locked up, and therefore more dangerous because unventilated, should not be allowed to go at all. In this way no car from an infected city would ever go near a healthy place, and if the germs of the disease are transported in the cars only, it is plain that the disease could not be transported from place to place. The only danger would be from the baggage of passengers; they might be prohibited altogether, or restricted to a minimum amount, and even stopped outside of every town, and opened, and ventilated before being carried into the town. The same rule is applicable to steamboats. It was to an arrangement of this kind, that in the great epidemic of 1855 the cities in intercourse with Norfolk escaped infection, — our intercourse with Hampton, Richmond, and Baltimore was uninterrupted throughout the epidemic, but never *direct*. Steamboats from those places came every day to Hampton Roads, and were there met by a small tug from Norfolk, which received their freight, chiefly provisions and coffins, and transferred passengers bound to those several places.

In order that this plan be effectual, it is all important that the existence of yellow fever in any city should be known as early as possible. If Boards of Health, and the newspapers in the interests of trade, conceal the truth as long as they can, which I fear is too often the case, it is manifest that this plan may fail, — for the germs of the disease may be already transported to other places, before its existence is announced by the authorities of the city where it commenced.

An expression of the opinion of a body, so respectable and influential as the Health Association, ought and probably would have great weight with Boards of Health, and prevent for the future the criminal practice of withholding from the public a knowledge of the existence of epidemic diseases, until it reaches such a height that it can no longer be concealed.

XIX.

PROPOSITIONS RELATIVE TO THE ÆTIOLOGY OF YELLOW FEVER.

By S. S. HERRICK, M. D.,
Of New Orleans, La.

READ AT THE ANNUAL MEETING, RICHMOND, VA., NOVEMBER 21, 1878.

I. THE natural forces always operate in lines of least resistance.

II. In matters pertaining to science, when our knowledge is imperfect and it is impossible to establish a theorem by actual demonstration, it is expedient to test various hypotheses, to ascertain which one is most conformable to known or accepted principles, — in other words, acts in the line of least resistance, — to adopt that hypothesis provisionally as a working principle, and to adhere to it as long (and no longer) as it agrees more closely than any other with the recognized laws of nature.

III. In choosing between two rival hypotheses, we should take the one which conducts us farthest without getting lost in the inexplicable.

IV. The theory that yellow fever is due to local causes immediately runs into the inexplicable, when met by such inquiries as the following: —

What is the nature of these causes?

If in sanitary conditions, why does not the fever show a decided preference for foul localities, and indeed prevail annually in all foul localities, without regard to geographical situation?

If humidity, or temperature, or barometric pressure, or electrical state be necessary factors in the result, one or more, what degrees and what mutual relations produce and modify morbific action? why also has the fever so limited a geographical distribution, and why should it become epidemic at a given place one year, and disappear another year?

How explain the observed facts, that the disease generally spreads from a focus, radiating in all directions; that it has been known to spread from house to house on one side of a street rather than the other, from one person to another on one side only of a partition wall in a hospital, and even from one state-room to another on one side only of an officers' ward-room? that the disease appears in a healthy locality after the introduction of fomites from an infected one, and not before?

How explain the action of frost on the disease?

V. The germ theory lights us farther than any other in searching the ætiology of yellow fever, by accounting for its appearance in unaccustomed localities, and at unexpected times through introduction of its germs in fomites; by the fact that investigation generally discloses the time and mode of their introduction, while occasional failure only shows imperfection of research; by its conformity to the manner and rate of progress of the pestilence, without regard to the sanitary condition, air currents, humidity, barometric pressure, or electrical state of localities; by more satisfactorily explaining its occasionally capricious mode of progress; by its absolute conformity to introduction of the disease through fomites, to its sure arrest by frost, and its probable arrest by such chemical agents as chlorine and sulphurous acid, where it is practicable to apply them thoroughly and completely to an infected spot.

VI. The supposition that the germs are reproduced outside the human body, rather than inside, explains the following apparent anomalies: attendants on the sick are scarcely, if at all, more liable to the disease than other persons in the same locality; individuals having contracted the fever by visiting an infected locality, and afterwards falling sick in a healthy one, usually do not spread the disease among those around them; individuals who have not had the fever have handled, swallowed, and even inoculated themselves with its morbid products with impunity.

COROLLARIES DEDUCIBLE FROM THE FOREGOING PROPOSITIONS:

I. Yellow fever is indigenous to certain lands never visited by frost, and does not obtain permanent occupation where the temperature annually falls below 32° F.

II. Yellow fever is exotic to the United States, and, once completely extirpated by frost or artificial means, will not recur, unless introduced anew by intercourse with infected regions abroad.

PROBLEM:

So to restrict and regulate this intercourse as effectually to prevent introduction of yellow fever germs from abroad.

XX.

EPIDEMIC OF 1864.

By D. W. HAND, M. D.,
Surgeon U. S. Army.

PRESENTED AT THE ANNUAL MEETING, RICHMOND, VA., NOVEMBER 21, 1878.

In September, 1864, a violent epidemic of yellow fever broke out at Newbern, N. C. An occasional case of that disease, brought from some other point, had been seen there before, but the only previous epidemic was in 1779, when a large number of the citizens died from it.

The peculiar condition of Newbern in 1864, offers some advantages in deciding the vexed question of origin.

In my reports to the Surgeon-general of the Army, of dates November 1, 1864, and March 8 and April 1, 1865, it was stated that my own opinion, and that of all the medical officers with me, was that this epidemic originated just there; and I now desire to give some of our reasons for that opinion. Newbern being at that time under martial law, and no one allowed to go in or out without the knowledge of the authorities, we have great advantages in fixing the point regarding importation.

A careful examination of the records shows that no vessel whatever arrived at Newbern from any point south of Beaufort, N. C., or from any infected port, during the summer of 1864. Nor can it be ascertained that any infected vessel came into Beaufort harbor during the months of July, August, or September, 1864, or that any case of yellow fever was heard of there until long after the disease appeared at Newbern. All vessels arriving at Moorhead City, and other points on Beaufort harbor at that time, were in the employ of the government, and all the sick on board were cared for by medical officers under the direction of either the fleet surgeon of the blockading squadron or myself, and any case of yellow fever would surely have come to our knowledge. Not having come into Newbern by water carriage, is it credible that it could have been brought in by some forlorn refugee struggling on foot through the swamps of eastern North Carolina? If so, whence could it have come?

I have the testimony of Drs. Anderson, Gove, King, and other prominent physicians of Wilmington, N. C., that no case of yellow fever was seen there that year until near the middle of October, and that even then it did not become epidemic. It is true that as early as August 29 two blockade runners were stopped at the quarantine grounds below the city, with cases of yellow fever on board, and that on October 1 fourteen blockade runners lay in quarantine at Smithville, near the mouth of Cape Fear River, and on all of them the mortality was great from that disease. It is not probable, however, that any person who had just run the blockade to get into the confederacy would immediately attempt to pass our picket lines to get out again; and the careful records of our provost-marshal have no account of any such person coming to Newbern at that time. It is also true that a case of yellow fever was seen at Charleston, S. C., on July 27, 1864, and that soon after the middle of August the disease became epidemic there. These were the points nearest to Newbern at which yellow fever appeared that year; and, owing to the rigor of military law, the communication with them was exceedingly limited.

At the "conspiracy" trial in Washington, in the summer of 1865, it was stated by witness G. J. Hyams *alias* J. W. Harris, that in July, 1864, he brought eight trunks of yellow-fever-infected clothing from Halifax, N. S., to Baltimore; and that after repacking this clothing it was sent to Washington and Norfolk. Judge Advocate General Bingham, in addressing the court, assumed that some of this clothing carried the disease to Newbern that year. By direction of Surgeon-general Barnes, I made a thorough examination into the facts of this case, and became entirely satisfied that no such clothing was carried to Norfolk, unless as private baggage; and that it could not have reached Newbern even in that way without our being able to find some trace of it. Seeing now how difficult, if not impossible, it was to import yellow fever into Newbern that year of 1864, what reasons are there for believing in its local origin?

This town is situated on a low, sandy plain, at the junction of the Neuse and Trent rivers; it is almost surrounded by swamps and marsh, and is densely shaded by large elm trees. In 1864 tight board fences surrounded nearly all the gardens and back yards, and the privies and out-houses generally had long been neglected. The drainage of the town was entirely on the surface, and owing to the flat location, so little above the level of the river, it was very imperfect.

The summer of 1864 was very hot and very wet. The thermometer averaged, at midday, in July, 83¼° F., and 85° F. in August; and during those two months there were few days without a shower of rain. In consequence the whole town was damp and mouldy. There is no regular ebb and flow of the tide in the rivers at this point; but a succession of strong southwest winds, in August, drove the water out, and for many days the tides were the lowest known for many years. This left extensive mud flats exposed to the hot sun. At the same time a new embankment, by order of the military authorities, was being made along the Neuse River front, and large quantities of filth-saturated soil were turned up and exposed.

During the winter of 1863–64, and spring of 1864, several small docks on both river fronts had been filled up in part, it was said, with stable manure and street cleanings, for the purpose of extending the wharves. Between two docks thus filled upon the Trent River front, was a row of old frame buildings then used as commissary warehouses, several of them being built on piles, with the river water formerly washing under them. Through carelessness, or neglect, no drainage was provided for the cavern formed under these buildings; and in consequence the summer rains made a pond under them, where dead rats and filth rapidly accumulated, and where the intense heat of August generated fearful poison.

Those conditions combined to produce the peculiar germ which causes yellow fever; and when we came to notice that the first and worst cases came from the vicinity of those old buildings on the wharf, we made an investigation. The floors were torn up, and a pool of stagnant water was found, the effluvium from which sickened the workmen. Here, we believe, was the starting point of that epidemic. The filth, the heat, the moisture were all there, and now we had the disease.

For several weeks the epidemic influence seemed to prevail with greatest force in the vicinity of the water, and was confined to a district two squares broad along each river bank. It was most violent in the rather old frame-houses, which on several streets were built directly on the ground, and were always damp; but every house in the infected district had more or less cases. In one three-story brick house, however, on one of the most infected streets, three maiden ladies lived entirely on the third floor, and thus escaped the fever. Gradually the epidemic spread over most of the town, and by November 1 nearly every person in the place had gone through with an attack of the fever. The negroes generally had it mildly, as did also the children, while with the aged, and persons recently arrived from the North, it was very fatal.

The population of Newbern, at that time, was estimated at nine thousand, full half of that number being negroes. Of the whites, about twelve hundred died between September 6 and November 1, and of the negroes, about one hundred and fifty. This includes those who died at other places, after having taken the fever at Newbern.

The fatality among the physicians in attendance was very great. In all during the epidemic we had on duty in Newbern, twenty-three medical officers, surgeons' assistants, surgeons, and contract physicians; of this number, twenty-one had the fever and eleven died.

As soon as it became apparent the disease was epidemic, as many soldiers and citizens as possible were sent away to Moorhead City, Beaufort, Hatteras, Roanoke Island, and other places, where many of them soon after sickened and died; but at no point, except Beaufort, did the fever extend to any other persons.

At Moorhead City the patients removed from hospitals in Newbern were placed indiscriminately in the wards of a large general hospital, and the citizens from Newbern thronged the hotel. Among these, twenty-one soldiers and thirty-four citizens died of yellow fever, yet not a single person there contracted the disease unless he had visited Newbern or Beaufort. At other points, the same immunity of non-exposed persons was noticed.

The town of Beaufort was badly crowded with refugees from Plymouth and Little Washington, and little attention had been paid to keeping the streets and houses clean. Among other nuisances, a slaughter-house, with most filthy surroundings, was afterwards found close to the most thickly settled part of the town. A few cases of the fever brought from Newbern here, started an epidemic which spread over most of the town. Fifteen soldiers and seventy-six citizens died there. At this point the epidemic did not, as at Newbern, cling to the water-side; and it was noticed that at the Beaufort General Hospital, which was projected out on the sea-front of the town, not a single case of the fever occurred among patients or attendants who had not been exposed elsewhere.

When, about November 1, 1864, this epidemic and all the facts relating to it were fresh in my mind, I wrote Surgeon-general Barnes that of three things I was convinced: —

1st. That it was of *local origin.*

2d. That it was not *malarial.*

3d. That it was not *contagious.* And now, after fourteen years, I see no reason to change my opinion.

ST. PAUL, MIN., *November* 9, 1878.

XXI.

DISINFECTION OF SEWERS BY OZONE.

By J. D. PLUNKET, M. D.,
Of Nashville, Tenn.

READ AT THE ANNUAL MEETING, RICHMOND, VA., NOVEMBER 21, 1878.

No fact in sanitary science rests upon a broader and more substantial basis of truth than that the gaseous emanations from decomposing sewage, commonly called sewer-gas, are a fruitful source of disease coming not unfrequently with the power and insidiousness of death. Especially is this fact realized by the larger cities of the world, as a glance at their mortuary reports will show; for, among them all, we find registered a very large percentage of deaths occurring from diseases of the zymotic type, which sanitarians everywhere now agree arise principally from sewer-gas poisoning.

To destroy, neutralize, or even to mitigate in some degree the destructive power of this potent agent is preëminently the leading, unsolved problem of the hour before the minds of the sanitary world. Various have been the theories proposed, and innumerable the ingenious mechanical devices applied; but so far, under the test of practical experience, one plan has followed another in rapid succession, until to-day we find them each and all labeled *failure.*

In a communication to the Academy of Munich, in 1840, Schönbein announced, that in the voltaic decomposition of water an odorous substance accompanied the oxygen evolved at the positive pole of the battery; believing it to be a new elementary body, and on account of its peculiar odor, he gave it the name of ozone. His views regarding it underwent several changes, and finally, in 1858, he concluded it to be negatively electrified oxygen; and to him belongs not only the honor of discovering, but also of demonstrating, most of the properties of ozone.

In 1845, Marignac and De La Rive showed ozone to be a highly oxidizing agent, which has since been confirmed by Andrews, Dr. Odling, Loret, and a number of others more recently, until to-day there is no difference of opinion among scientists as to ozone possessing, in an intense degree, the power of oxidation.

The most careful analyses show that sewer-gas is composed chiefly of carbonic acid, nitrogen, sulphuretted hydrogen, ammoniacal compounds, and fetid organic vapor. By an experiment of Schönbein, air made foul by exposure for one minute to four ounces of highly putrid meat was found to be disinfected by an equal volume of air containing only one part of ozone to 3,240,000 parts of air, and, by an experiment of a more recent investigator, it was found to destroy the offensive smell of rotten eggs instantly. Therefore it may well be assumed that ozone is the natural and effectual destroyer of the products of decomposition of azotized substances which, in the form of sewer-gas, we have found to be a prolific source of disease. Again, recently, Carey Lea, of Philadelphia, has demonstrated that ozone exerts a destructive influence on low forms of vegetable life — mould, and other such simple vegetable structures, being completely destroyed when exposed to an atmosphere containing it. Upon these, and many other kindred facts, which are now generally received as having been settled in science, it is modestly suggested that this subtle and potent agent be utilized in the disinfecting of sewers and other similar sources of mephitic gases. To accomplish this, it is proposed to create a continuous stream of ozone through the length and breadth of every sewer; penetrating, as it will, every crack and crevice in its eager search after the gaseous products of decomposition, we are led to conclude an effect would thus be produced which, in result, would be equivalent to extracting the fangs of the serpent. This, we believe, can be realized by means of an interrupted wire run throughout the length of each sewer, and attaching the same to either a Rumakorff coil with battery, or, by the aid of steam and proper apparatus, to generate electricity sufficient to supply the electric spark at each interruption of the wire, and thereby produce continually ozone which, thus liberated, will go forth in its power to antagonize and render harmless the hydra-headed monster, sewer gas.

XXII.

THE PROPHYLACTIC TREATMENT OF INDIVIDUALS AS A MEANS OF PREVENTING EPIDEMICS OF YELLOW FEVER OR OTHER INFECTIVE DISEASES.

PAPER PRESENTED TO THE PUBLIC HEALTH ASSOCIATION, RICHMOND, NOVEMBER, 1878.

BY EZRA M. HUNT, M. D.,

Secretary of the State Board of Health of New Jersey.

As to all infective diseases, four questions are prominent: I. Origin; II. Modes of propagation; III. Methods of prevention; IV. Treatment.

In this paper we shall not discuss the origin (I). We shall take it for granted that the *mode of propagation* (II.) is by infective particles, mostly received through the air-passages, which, passing into the human system, produce that toxic and abnormal condition which constitutes the disease.

The treatment (IV.) we leave to be discussed by those who, after heroic contention with the recent epidemic, still live to contribute their experience.

Our present intent is only to inquire as to methods of prevention. To this inquiry there are many prompt replies.

Those, for instance, who regard yellow fever as an infection imported every time it first appears, fasten attention on the marine. To such — so far as the United States is practically concerned — that is the origin, and such propose its abolition coastwise. That may be so; and all along the line we would put the forces of sanitary art on duty, as if that were *the direction* of danger.

But so often has the enemy entered while watched, so hard is it to watch so as to prevent landing atoms or molecules so small that the microscope and the Tyndall light reflectors have not revealed them, and so variable are the convictions of skilled students of epidemiology, that by common consent other methods of prevention are not to be dispensed with.

The seoond answer is; prevent by cleanliness of surroundings — purity everywhere. Not one whit would we demur from that enforcement. But we are to remember that massed population, without *any* animal organic matter around, and vast areas of territory without *any* accumulated vegetable decay, are difficult of realization. To remove or disinfect all such decay is a herculean task. If infective particles only await the coincidence of heat, moisture, and accumulated decompositions, they stand large chances of finding these somewhere. The effort is to be made, because partial success means limitation; but we may not entirely trust to this for the abolition of infective diseases.

Is it not also well, just here, to note that with all that is said about FILTH, yet the infective particles, having been originated elsewhere and arrived in cargo, it is yet to be proven that outside filth is the soil for such particles. Is not the soil in the individual? Does not the infection go straight for the human being as its place to feed, and grow, and display its sad vigor of force? It is not *dependent* upon collateral outside aid now. The vicious entity has arrived as a plenipotentiary. For display of power it only needs a man, a woman, or a child, even if occasionally accepting the aid and abettal of outside servants. We believe that filth is evil, and only evil, and that continually, and that it often assists to intensify infective diseases, but more because it embarrasses individuals in their resistance than that it invigorates infective particles for the higher organism on which they feed, and to which they, by their own ill instinct, resort.

Sir Thomas Watson, Bart., M. D. (1877), goes so far as not only to call the *body* the soil in which the infection finds its sought-for nidus and food for growth, but accounts for the *single* attack of many infective diseases, on the view that the first seizure exhausts some one or more of the indispensable ingredients only to be found in the man.

The next reply, and the most usual resort, is *treatment.* It hopes to limit by staying the progress and abating the severity. This, though not preventive to the individual concerned, does probably limit the production of infective particles, and result in fewer seizures. But new discouragements await us. Some of these infections, like plague and yellow fever, so rapidly change vital fluids, or congest or disorganize, that the system is incapacitated for the appropriation of remedies so as to obtain their physiological and medicinal effects. In yellow fever, for instance, the earliest and radical changes are in our great dependency, the blood. It is a blood-poison.[1] With the introduction of a foreign irritative there is rapid decomposition, *i. e.*, separation of its constituent parts, impairment of the blood-paths to the remotest arterioles, and paralyzation of the vaso-motor nerves[2] which control them. The blood is very early acid, the red corpuscles are diminished in size, shrunken, and crenated, and their coloring matter becomes free in the blood, thus changing from hemoglobin to hematin. The fibrin is diminished so as not to coagulate; the walls of the vessels lose tone, and show germination of the nuclei of the muscular coat of the arterioles and early fatty degeneration.[3] Organs are affected not so much specially (idiopathically or primarily) as by virtue of a tendency to congestion consequent upon the primary toxic shock on the blood and its ducts.

I happened to be reading side by side the report on the minute anatomy of twenty-three cases of malignant scarlatina by Klein, and similar examinations of yellow fever by Schmidt, etc.,[4] and could not but be impressed with points of comparison.

Here is one: It would seem as if, "under the influence of some stimulus (perhaps some blood-irritant) which the disease supplies, the arterial muscu-

1 Schmidt. 2 Huxley, p. 62.

3 Compare Klein, p. 47.

4 Privy Council, New Series, No. 8, 1876, p. 24; *N. C. Journal*, September, 1872 and 1873.

lar tissue has been exceptionally exercised. Query, whether this exceptional exercise of contractility affecting the calibre of the arterioles may, during life, shut the glomeruli out of the circulation, and may thus, so far as it operates, suppress the secretion of urine." [1]

Professor Joseph Jones[2] notices "the rapid putrefaction of the blood of yellow fever after its abstraction from the living body, as also the rapid dissolution of the colored blood-corpuscles."

The hopelessness of treatment in severe cases is inseparable from the involved lesions of the disease. It is much the same as with the concealed imbibition of an acid poison, for it thus impairs structure as much as does a fretful corrosive in contact with living parts. If we had antidotes we would be too late.

In view of all these facts, as to the incompleteness of our prevention, by coast guard, by cleanliness and disinfection, and by after-medication, we are almost driven to ask whether we may not turn from surroundings (circumstances) and come to deal with individuals before the manifestation of disease.

Is it not worth yearning inquiry if we cannot put individuals in such a condition of unreceptivity as to exempt them from seizure, and so not only save them, but thus limit the disease below epidemic proportions, and in the end, by all the methods combined, accomplish well-nigh its subjugation?

Such limitations do take place in nature. Unsusceptibility to attack under actual exposure is not a mere fortuitous circumstance; we recognize it as acquired by the individual when we call him acclimated.

That protection must be of an internal character. Such limitations are often established when a disease once had secures immunity from any subsequent attack.

It is not unthinkable that somehow we, too, may put the individual in at least such temporary condition as that the infective particle will not alight upon him, will find a surface on which it cannot or will not operate. That we do not do this after a disease has made alteration of structure and accomplished suspension of function, is not surprising. Nor is it at all strange if the same remedies, which are useless or feebly operative or positively injurious in the disease, might yet avail before its outbreak.

What then can we do to the individual so that when the particulate or molecular infection comes along it shall find a surface unfriendly to its lodgment, or the blood and secretions or the membranes so preoccupied, prepossessed, preëmpted, that the disease cannot take hold? There is an answer which has to do with mechanical prevention. If cotton-wool will detain saprophytes, we can conceive how, were it practicable, the air-passages might have infective particles strained out and left without.

But more practically we may look to the entrance-chamber for all air and food. The mouth, the glands, the lymphoid follicles, the character of the membrane, its whole series of absorptive apparatus, as revealed by histology, and the manifestations which in some infective diseases do take place just there, and the evidences in others of absorption from thence, cannot

[1] See Klein, p. 58. [2] *N. C. Med. and Surg. Journal*, September, 1874.

but excite watchful inquiry. That is a suggestive remark of Dr. William Farr, in the Thirty-eighth Annual Report of the Registrar-general of England, when referring, as he calls them to "the seeds of zymotic disease," he says, "Inspiration bringing them into contact with the mucous membrane of the nose, throat, and air-tubes, easily infects the moist surfaces with their venom."[1] There are some infective particles which are local in effect, as well as conveyed by absorption, before they are wholly constitutional. With infectives which enter from without it applies to the individual as well as to the State to guard the port of entry.

Since it is possible that infective particles might be detained mechanically or affected chemically, or, if living matter, like other animals or vegetables, might have their instincts or choices of locality, or that corrugated surfaces or certain odors or presences might prevent activity or absorption, the question is not irrelevant, whether we may not, by dealing with the most accessible mucous surfaces which all these particles have to pass over or lodge upon, somehow embarrass entrance or suspend their proclivities. But in a disease like yellow fever more important is the question whether the setting up of those absorptive, proliferative changes which the poison would initiate, cannot be prevented by introducing beforehand and securing the sustained presence in the blood and system of substances inimical to the infective particles in their attempted occupancy and disorganization. Now note a few facts from competent observers, not offered by them in support of a hypothesis, but occurring in the course of other investigations.

Professor Polli, of Milan, in his paper before the British Medical Association, 1877, entitled, "Observations on the Treatment of Zymotic Diseases by the Administration of the Sulphites," showed by his experiments that the bodies of animals that had been fed on the sulphites resisted putrefaction longer than similar animals not so fed, and so rendered it probable that certain resistive conditions can be maintained in the living body for a time (although he did not hint at the application of the principle to the prevention of disease). Still more suggestive is the fact that urine passed by the animals while living "did not undergo ammoniacal fermentation for eight days during the hot Italian summer."

Is it not tenable to ask whether we may not, by infusion of the blood, interfere with septic infections before they have crippled our power, and thus prevent their recognizance or make the malign benign?

In a recent discussion which took place at the Paris International Congress of Hygiene (1878) M. Bugy alluded to his own careful watching through several cholera epidemics as to the singular exemption of workers in copper. He had himself satisfactorily experimented with it. "The point was to become impregnated with the copper — to have a certain quantity in the system — so as to obtain immunity." He explained the escape of Aubagne, between Toulon and Marseilles, from three cholera epidemics in this way. M. Mormisse declared his confidence in this prophylaxis.[2]

The influence of continuous doses of arsenic in suspending the effects of vaccination, and its value as a prophylactic in an epidemic of rinderpest, is

[1] p. 232.

[2] See *London San. Record*, August 16, 1878, p. 106.

claimed as a result of experiments and observations by E. J. Syson, English Medical Officer of Health.

Some reputable observers in our country, as alluded to by Professor J. G. Cabell in his late address before the American Medical Association, have been hopeful in their success with other prophylactics in diphtheria and scarlet fever.

So good an authority as Professor Binz claims that the antipyretic action of certain articles is a result of their antiseptic power.[1]

But we scarcely need to look thus far for evidence.

If we follow the clinical history of cinchona, we find that, from being ranked as a specific or antiperiodic, it has come to vindicate and define itself as an article introduced into the blood which interferes with the domination of at least one specified infection. Chill and fever is admitted to depend upon infective particles received from without. Susceptible persons, who have never suffered an attack, are prevented therefrom by the introduction of the alkaloid as a prophylactic. This distinctly means that one outside infection known to be able to initiate and carry on prolific diseased action is deprived of that ability and suspended in its exercise of power by dealing with the individual easier than by dealing with his surroundings. It is the unimpeachable witness that in one notable class of cases it is possible to place beforehand in the blood, and, by repeated doses, keep present there, that which does suspend the animation of at least one infection, and so prevent the disease.

This is so well admitted that, as a reminder, we only need to refer to such a summing up and such an example as that recorded by Professor H. C. Wood, Jr.[2] "The value," says he, "of the daily use of quinine to persons exposed to a malarial atmosphere has now been thoroughly tested in all portions of the world. The testimony is unanimous in its favor." A single citation will serve to illustrate the fact. Dr. J. B. Hamilton[3] reports the case of a battery of 135 men quartered at Jubbulpore, East Indies, in the same barracks with an infantry regiment. Each of the artillerists received three grains of quinine every other day; to the infantrymen none was given. The result was, that whilst 300 out of 500 men of the regiment were sick at one time with malarial disease, at no period were more than four per cent. of the battery affected.

Says Professor R. Bartholow: "Quinia is used to prevent malarial *infection.* Numerous instances have been reported in which those using quinia as preventive of malarial poisoning have experienced an exemption from malarial diseases when exposed to the most deadly miasma." *This great outstanding fact that there is one article which, given in advance, can vacate one infection, is never to be lost sight of in thinking of an epidemic.*

Because it so happens that quinine also aids to overcome the developed disease, we are not to obscure it as a prophylactic to at least one infective.

It is always possible, and in some degree probable, that the same article

[1] See *London Prac.*, xvi., p. 443, quoted *Phil. Med. Times*, September 28, 1878.

[2] See *Materia Medica.*

[3] *Indian Medical Gazette*, November 1, 1873.

which acts so as to supersede an infective particle, and so prevent its self-assertion, will also act as a restraint, or as a curative, in maladies where the first paroxysm is not destructive, or the toxic tends to expend itself without malignancy.

But because any article does not prove a remedy in an attack we cannot infer its inertness as a preventive.

In some infections the era of manifestation is that of indisputable supremacy. The force is so explosive, the tainting of fluids and the disorganization of vital parts so early, or the exacerbation so distant, that we cannot hope to suspend an action hastening to the bitter end. The prophylactic in the severer cases may even prove an irritant, just as restoring food will irritate a perverted stomach.

That quinine has any superseding effect, after a malarial infection has had constitutional manifestation, is far more likely, owing to its less pernicious endowment and its periodicity of activity, than to any specific relation between this one infection and the alkaloid itself. While each kind of infection has its characteristics, yet they are allied in their methods of dealing and in their effort to set up septic processes.

We are greatly interested in experiments by Mayer, Hallier, Herbst, Polli, Binz, etc., which show the wonderful protective power of quinine before any infective action has been declared. In the proportion of 1 part to 300, it will preserve milk, urine, albumen, etc. It acts upon infusoria as well as upon the ordinary mould or fungi.

It may as appropriately be called anti-infective as anti-septic, quelling that movement which is the process by which the infective molecules of the inbreathed poisons do initiate their work and accomplish their virulence. Through the blood, in an unembarrassed state, "the cinchona alkaloids diffuse with great rapidity." Increased fluorescence is discernible in the crystalline lens in a half hour after its administration, and as soon as that it is also present in the urine. It is possible even by small doses to maintain for a length of time its presence in the blood, as it is easily held in solution, or minute division in it (B.). "Recent researches have quite accurately demonstrated the nature of the action of quinia on certain constituents of the blood. It is a protoplasmic poison."[1] It tells upon cells and all amœboid movements.[2] Amœboid movements are checked by it when only 1 to 4,000 parts is present. It impedes those blood-changes which are a part of the noticed effect of most infectives in their initial work.[3] It acts forcibly on all animal germinal matter, as well as upon the fungi which are the immediate cause of so many destructive changes.

With such facts as to a substance which it is possible to maintain for a considerable time in presence in the blood and secretions, and with the fact certified beyond dispute, that at least one class of infective particles, having entered into our being, *are* circumvented, suspended, and, so, any manifestation of disease prevented by this antecedent treatment, ***have we not a prophylaxis of the individual which should make us intensely hopeful as to all those infective diseases received from without in a similar way?***

[1] Bartholow, *M. M.*, p. 127. [2] Compare Frey, p. 12. [3] See Wood, pp. 60, 61.

While there are destructive infective particles put in from without, there are also preservative and conservative particles to be put in which establish and maintain a condition of resistance.

What acclimatization does; what once having a disease often does; what vaccination does; and, most of all, in its present bearing, what quinia given in advance does, to prevent demonstration by the infective particles of malaria, make it not chimerical to be intensely hopeful that some other infective particles may be prohibited from that exercise of their power which is the fatal disease, by timely infusion into the blood of antagonistic elements which, in order to be timely, must be antecedent, prophylactic.

Two other articles may be alluded to as illustrative of the seeming control which can be exercised by a continuous presence in the blood of antagonists to infective developments.

Chlorate of potassium, there is reason to believe, interferes with the action of infective particles. It is easy of absorption and maintenance in the blood "if the stomach be in a condition to absorb anything."[1] Isambert found it in the saliva in five minutes after ingestion; in the urine in ten minutes, in which it continues from fifteen to forty-eight hours; in the nasal mucus, the tears, and the bile. Its power of permeation and harmless sustentation, and its aid in disposing of the products of change so as to render them innocuous, is most manifest. It dissolves albuminoids, of which many conceive infective particles to consist, and insures the gradual oxidation of the organic constituents of fluids.[2] Its introduction as a medicine,[3] its power over aphthæ and ulcerative stomatitis, the identification of cryptogamous growths,[4] and fungi in some of the diseases over which it has chief control, are in accord with its hoped-for power over morbid processes dependent upon inhaled infections.

Tincture of chloride of iron — tinct. ferri chloridi — is another of the articles to be hopefully watched as likely to fortify the system against susceptibility to some infective particles, and to prohibit the rapid disintegration which they attempt.

As preventive of the sedation or coaptation of infective particles to mucous surfaces, its corrugating and antiseptic effect is such locally as to interfere with implantation and absorption. When in the blood, it not only increases the contractility of the vessels mechanically, but also aids their vital contractility.

Our power to modify the condition of the blood by the use of this agent has received some interesting certification more recently.

The white and red corpuscles are seen to play not only the important rôle in health, but to be subject to great disturbance and diminution in rapid infective diseases. By means of Mal-as-sez, "Compte-Globules," or Globule Reckoner, or with the Hæmacytometer,[5] we can see what takes place under the administration of iron. The experiments of Rabuteau, in Paris, and of his confrères (see cit.), and of Professor Gowers, of London, show what con-

[1] Barker, p. 410. [2] B., *M. Med.*, p. 638. [3] See West.

[4] Gruby, Berg, Condie; Watson, p. 485; and Niemeyer, chaps. 1-8, vol. i., pp. 414-430.

[5] See *Phil. Med. Times*, September 28, 1878, p. 623.

trol we may thus exercise over blood-conditions. Even white blood-corpuscles can be made to take up small foreign particles.[1] Our own prophylactic use for diphtheria and scarlet fever has been highly satisfactory. It seems to act directly "on the blood as an ozonizing agent." The chloride of iron, well laden with oxygen, chlorine, and iron, and having, in addition, muriatic acid, alcohol, and muriatic ether,[2] is resistant of infective degradations, and only fails in some of them as a remedy, because already its power is surpassed and outridden by that of the infection, and by the inability of the diseased vessels to deliver it.

We allude to these as illustrations of hopeful prophylactics, to which not unlikely may be added salicylic acid, arsenic, alcohol, sulphurous acid, and some sulphites and chlorides found to have some restraining prophylactic power in general or in special adaptation to some classes of infectants, even though they entirely fail as remedies.

Our desire in this presentation is to draw special attention to the dealing with the exposed but unattacked individual amid rapid and destructive epidemics, instead of dealing only with everything outside of him. The scourge is so portentous and the ravages so dire, that, while not neglecting any outside methods, we would be inquisitive as to what can be done upon the individual who cannot betake himself to flight.

May we not closely study his personal cleansing by detergent and antiseptic methods at his points of contact with the infected atmosphere about him? May we not ask how we may guard the common avenue of approach and protect its membrane, and all the more since in yellow fever the inbreathed air is esteemed the common carrier of the infection?

Shall we not most of all emphasize the facts which justify us in testing and asking others to test our ability to suspend the infective process by having present in the blood organs or tissues such catalytic substance as shall either destroy the infective particle, or, as this is not essential, so stupefy, embarrass, or suspend it, that it shall not be able to set up critically that morbid series of actions which constitute the violence of a disease?

The article of Dr. P. Selis, of Havana, as quoted in the "N. O. Medical and Surgical Journal," September 7, 1878, in reference to the Preventive Treatment of Yellow Fever in Havana, deserves to attract attention.

The ground of such hope is quite different from the hypothesis of specifics for each disease, but is based upon what does actually take place in prevention of malarial attacks, what is asserted by respectable authorities to have occurred as to diphtheria, scarlet fever, etc., and what may attach to many articles by virtue of their ability to infuse into the blood a resistive principle.

This is far more probable since we have come to know that we can for days maintain in the blood certain substances which are known to interfere with the progress of changes similar to those which infective particles set up, and can perceive uniformity of effect if only the element is introduced before the toxic has embarrassed or nullified its capacity by changes already wrought.

[1] See Frey's *Histology*, p. 24. [2] West, p. 81.

After once having secured the presence of some such substances, as we have named, as manifested in the saliva, urine, etc., it takes exactness of method and real discipline of administration, but very small doses, to maintain this action up to the point of securing resistance or benignancy.

The embarrassment to any one proposing such a method is, that so many claim to have tried these as *remedies* without avail, and so infer against their prophylactic value, or else have made trials in this direction which lack precision, continuance, and sufficiency of numbers.

We shall never lose the expression of Professor Lister, as, one day, in his own Edinburgh University Hospital, he said: "I am always willing to be informed by the testimony of capable observers and accurate manipulators; but so many annoy me by having *somehow* used an antiseptic, and then telling me they have tried my method without success. When I come to find out what they have tried, I generally find that they have tried piecemeals, and these piecemeal failures should only stand as the tokens of inadequate trial and imperfect details."

It is just so with very many prophylactic trials in the past. There have been a few exact observers, and a few trials which, as far as they go, have been expert; but there has been too great paucity of cases, as well as too few who have observed and tried *this* preventive method on a plan.

What we want is, that a large number of persons in an infected locality shall be put under exact individual prophylaxis, under continuous medical supervision, with prescribed conditions of test. It will not do to rest on doubts and denials, accompanied by no particulars which will enable others to arrive at conclusions, nor, on the other hand, to accept without items such a statement as that of the New Orleans correspondent of the "Times,' who, under date of September 20, says: "There has been sufficient evidence adduced to show that quinine is prophylactic. One orphan asylum, containing fifty-six children, has not had a case so far. Since the outbreak of the epidemic each child has been constantly under the influence of the drug. Within your correspondent's knowledge there are fourteen unacclimated persons who have thus far escaped, although constantly exposed, who have regularly taken six grains of quinine a day in conjunction with arsenic." We since find the evidence still stronger.

All we claim is, that, with the facts as we have stated them before us, the time has come when we should be ready for a precise method of prophylaxis in the first epidemic, such as shall confirm or disprove views that are entertained.

Early in the recent epidemic some such views were expressed by us and forwarded with courteous attention; but the variety of other suggestions, and the emergencies of multiplying cases and deficient aid, prevented satisfactory trial.

If only thus we can prevent — *i. e.*, go before the infected particle has had individual manifestation, as does quinine before the infection of malaria — we shall assist the other methods practiced in a most radical and important way, and add to future hopefulness in the limitation of all infective diseases.

NOTE.

THE OMITTED PAPERS, REPORTS, AND DISCUSSIONS RELATING TO WORK OF THE COMMISSION TO INVESTIGATE YELLOW FEVER.

As the greater portion of the first two days of the Annual Meeting at Richmond was occupied in the reading and partial discussion of reports and statements of the gentlemen who were engaged in the investigation of the epidemic in the Mississippi Valley, the publishing committee feel that it is due to the Association, as well as to readers of this volume of Transactions, that a brief explanation be given for the absence of those papers, etc., from this publication. In the brief address of the Chief of the U. S. Marine Hospital Service, November 19, at the opening of the meeting in Richmond, as printed in this volume,[1] and likewise in the official announcement of the meeting, the fact appears that the original purpose of the officers of the Association and of Dr. Woodworth, who in his capacity as Chief of the Marine Hospital Service had appointed the Commission of Investigation, was, that whatever might be gleaned and reported up to the date of the Richmond meeting should be submitted to the Association for its discussion and counsels, and that the further prosecution of the investigations should be guided by the counsels so given.

The vast amount of written and verbal evidence and narrative submitted, the numerous maps, records, and partially completed reports arrayed by the Commissioners, and the great question mooted by them on the personal contagiousness, localizing conditions, the failure of various sanitary measures, the utility of inland quarantines, and an absolute isolation of infected things and sick persons so occupied the Association's time that the expediency of suspending the discussion until the reports and evidence should be completed, and for the present expressing no final conclusions upon any of these questions, was apparent. The opinion of the officers of the Association who had promoted the organization and work of the Commission was in harmony with this prevailing impression among their fellow members. Under these circumstances the Commissioners and Dr. Woodworth were allowed to act their own pleasure in regard to leaving the voluminous papers and charts as submitted, incomplete, in possession of the Association. Very naturally these gentlemen preferred to complete and publish the results of the Commission researches in a separate volume. The Executive Committee of the Association relinquished any claim that might interfere with such preference, and with the sincere desire not to impair or divide any good results of the researches and conclusions of that Commission, whose work, up to the time of the Richmond meeting, had been simply pre-

[1] See pages 10[illegible] and 10[illegible], ante.

liminary and tentative, unanimously voted to omit from these Transactions any use whatever of the contributions which they were then informed would appear in a separate publication.

Congress having, immediately upon its assembling, supplied means ($50,000) for prosecuting the investigation which the Commission had commenced, and at a later period having provided amply for the publication of all the results, the Public Health Association, in common with all who await those results, looks to the promised publication by the Government.

ABSTRACT OF PROCEEDINGS AT THE ANNUAL MEETING IN CHICAGO, 1877.

DISCUSSIONS. Tuesday, September 25.

[A.] *Problems of Sanitary Engineering in Chicago.*

(Following Paper and Illustrations submitted by C. S. Chesbrough, C. E.)

Mr. Chesbrough hung an outline sketch of the city of Chicago on the wall, with lines showing the depressed portions of the city's surface, and said: —

I would like to point out two or three things in connection with the chart. The blue line on the east represents the lake shore. The other blue lines represent the Chicago River, the North Branch, the South Branch, which divides into the South Fork and the West Fork. The dimensions of the city are seven miles from north to south, by five miles from the lake shore to the west side. The Illinois and Michigan Canal, mentioned in the report, begins at the South Branch, near the Forks of the South and West Branches. The canal is fed by the lake water which runs through the South Branch. The Des Plaines River at one point comes quite near Chicago; and between that point and the South Fork of the river is an old portage, used by the early French travelers and settlers, and afterwards by traders. The Des Plaines River flows near the lake shore, — so near at Waukegan that the distance between the lake shore and the basin of the Mississippi is only a mile.

A line represents the level of eight feet above the average surface of the lake. All the ground east of that line is less than eight feet above the level of the lake. There are certain points in the city more than twenty feet above (as at the extreme southern portion and the extreme northern portion), and on the west side there are two points where the rocks appear at the surface.

The Ogden and Wentworth Canal, mentioned in the paper just read, was constructed by its owners to drain extensive lands; and they carried it up until it tapped the Des Plaines River. The paper mentions that, after the completion of the canal, the Des Plaines River flowed this way instead of into the Des Plaines. The consequence was that the water which came from the Des Plaines down the Ogden Canal in the Chicago River, instead of running into the lake fed the Illinois and Michigan Canal, thus preventing the pure water from the lake passing into the South Branch of the Chicago River.

Fullerton Avenue is the north boundary line. The Fullerton Avenue Conduit passes from the North Branch to the lake. The conduit itself is already constructed, but the machinery has not yet been contracted for. It is intended by this conduit to force a stream from the river into the lake, thus doubling the quantity of pure water now passing from the lake into the main river to feed the canal. If that should be done, the quantity of fresh water coming in would be doubled; and the water passing into the South Branch would be much purer, and an equally pure body of water would pass up the North Branch, entering the conduit in ordinary seasons.

The paper states that in ordinary seasons there is no current in the Chicago River in either its North Branch or the South Branch. A high wind from the north will make a current up stream in both branches, and a strong wind from the south will make a stronger than ordinary current into the lake. In the spring, at the breaking up of winter, there is a great deal of water flowing through the North Branch and the South Branch, and at such times the water flows out with a very strong current, so that the entrance of the tunnel is within the limit of the muddy water from the river. Of course the purity of the water is affected. As I mentioned before, these black lines represent the levels of eight feet above the ordinary lake level. You see how large a part of the city is below that level.

Question (by a member). How much is the bed of the canal, at its junction with the river, below the bed of the river?

Answer (by Mr. Chesbrough). The bottom of the canal is about six feet below low-water in the lake; not below the bed of the river, because it is navigable for vessels drawing fourteen or fifteen feet of water.

Q. Will Mr. Chesbrough please to state again the reason for using the circular shape of the sewer, instead of the egg shape?

A. At the time we commenced operations here, the surface of the city was very low; between the lines above-mentioned, less than eight feet above the lake level. If the sewers had been egg-shaped, of course the larger they were the higher they would have been, projecting up one or two feet further. Consequently, in order to protect them from frost, it would be necessary to raise the streets so much higher, and that was a matter of some importance. Another reason mentioned is this: where the sewers are above the flow, and have no back-water in them, and only the ordinary drainage of a town flowing through them, of course the egg-shaped form gives more foundation; but here, sometimes for a year or more, the sewers would be half full or more. Then the egg-shaped form has no value whatever. Again, in our city, being not so neat as they are at the East, more rubbish gets into the sewers; and that very soon makes a flat bottom, so that the egg-shaped form would be rendered inefficient.

Q. Is the engineer department in charge of the removal of the contents of the catch-basins at present?

A. Yes.

Q. How is that work carried on?

A. It is lifted into wagons.

Q. What is done with the fluid?

A. The catch-basins are generally filled with sand. The material is only semi-fluid, and very frequently the catch-basins are filled with sand.

Q. I was speaking more particularly of the water above the silt.

A. This is usually poured into gutters. The men bail it out, and dam up the gutters; and when the silt stuff is removed let the water return again into the basin, and fill the basin with fresh water from the hydrant, so as to prevent the gases coming up.

Q. You say you make a dam to keep the water back?

A. We wish to avoid the useless expense of carting away the water, and so put it into the gutters in the street.

Q. (by Dr. Churchill, of Galesburg, Ill.). What is the length of the longest sewer that discharges into the river?

A. About three miles.

Q. Is the inclination sufficient?

A. The paper does not go much into details in regard to these things; but I think it mentions that the largest sewers have an inclination of two feet to the mile, increased to ten feet to the mile in the twelve-inch pipes. The farther the sewers go west the smaller they become, and the greater the inclination.

Q. (by Dr. Foote). What is the size of the largest sewer?

A. Six feet.

Q. (by Dr. Ames, of Massachusetts). Have you ever formed any opinion from experience as to whether the contents of the sewers might not be removed in a more sightly and more healthy way by means of the pneumatic process?

A. That has been thought of a great deal. It would be more sightly. We never have supposed the contents to be unhealthy. It certainly would be more sightly in many parts of the city. The pneumatic process has been talked of frequently. The trouble is this: The openings into the catch-basins are large enough to let all sorts of stuff thrown upon the streets go into them, — such as rubbish, chips, and sometimes branches of trees, — and of course they would stop up any suction-pipe you might have in connection with the pneumatic process. That could be readily applied where the stuff is semi-fluid or homogeneous; but with stones, chips, and things of that kind it would not work very well.

Q. Do you get much odor?

A. I never have noticed any odor from these catch-basins. The ordinary surface matter is not offensive.

Q. What becomes of the fluid in privies that do not connect with the sewers?

A. Privies, as such, are not connected with the sewers. The water-closets are, and the currents of water in the sewers take all such stuff into the river.

Q. (by Dr. H. A. Johnson). The catch-basins are in the streets. Is there anything in these catch-basins except the street washings?

A. Nothing ought to go there except the street washings. The catch-basins were put there to prevent heavy stuff from getting into the sewers, and thus making its removal expensive. If you let sand get into the sewer and spread along, it costs more to remove it than if in the catch-basin.

Q. (by Dr. H. A. Johnson). I would like to ask one question, and that is, Whether, if our present system should be found inadequate, there is any arrangement whereby intercepting sewers can be added to our present system?

A. In a report made to the city in 1858, nineteen years ago, on this subject, it was said that nothing had been done in regard to this matter. The same is true to-day. Nothing has been done to prevent the carrying out of a sufficient system of intercepting sewers. Intercepting sewers would run each side of the river, and receive the drainage from the present sewers, which would only discharge into the river during heavy storms. It would not be advisable to make intercepting sewers to carry off all the storm-water in the city; but they would be large enough to carry off the ordinary sewerage of the city.

Q. Where would the outfall be?

A. This is a question that I could not solve twenty years ago, and I do not know how to answer it now. If any one can tell what is the best disposition to make of the sewerage matter, we can tell where the outlet ought to be. If the best thing shall prove to be to put it on the farms, then the outfalls of these intercepting sewers should not be on the lake shore, but as near the farms as possible. You cannot tell exactly where Chicago will stop. If the lake is to be the permanent receptacle of the sewerage of the city, then the outfall may be one or more. Originally it was thought one outfall might be made. Now it is thought better to make two; but, as mentioned in the paper, there is a great deal of sensitiveness about the lake, lest it should be so polluted as to injure the drinking water. Besides, there are suburbs north and south; and of course the people of these suburbs are ready to cry out against any more sewage in the lake. What effect these things will have upon this question I do not know.

Q. How much wider and deeper would the canal need to be made, in order to carry off the sewage?

A. Some persons contend it is large enough already; but we would much rather have it larger. I think, if it could be doubled in width and deepened enough for steamboats, as has been proposed, it would be sufficient for more than a million of inhabitants; but that, of course, depends upon how much filth is made by a city, and what is done with it.

Q. (by Dr. Ingalls). Has any estimate been made of the cost of such work?

A. I have seen it variously stated, of from $7,000,000 to $10,000,000. The deepening of the old canal cost over $3,000,000, deepening it about six feet. This would have to be widened and deepened as much as the old one, and two or three feet besides. In doing the new work, the contractor would have to contend with a large amount of rock and earth thrown out on the side of the present canal. I think the estimates would be from $7,000,000 to $10,000,000. Possibly it might cost more; but, for so important a work as that of completing a chain of steamboat navigation, it would not be a large amount.

[illegible]

[illegible] —

[illegible] It seems to me that the [illegible] through Europe and Asia for [illegible] the people see that they [illegible] We have nothing at the present time like the [illegible] in those European cities. In making these remarks, one of the important things we ought to bear in mind is that it is necessary for the human race to move step by step in its stages of improvement. It is impossible to make any great strides at one time. It is impossible to make people believe their pockets are affected, unless they are affected in a direct way. [illegible] that the average duration of life in the Middle Ages [illegible] no one would believe it. The people of London two centuries ago, if told that the average duration of life could be increased fifty per cent., would have thought it a chimera. At the present time, our people in cities are satisfied provided the vaults are taken care of so as not to be offensive. So long as water is not foul merely, people cannot be convinced that it is seriously injurious. There are provincial towns throughout the country now where there are private vaults that have not been emptied for many years, and wells that have not been cleaned for a century. Thus in country towns we have had a death-rate from diphtheria which would represent 5,000 deaths in Chicago. In a small town it attracts no attention; but in a large city it would be looked upon as appalling. The people in those towns cannot be convinced that it touches their lives and pockets; but in large cities there are many things that do touch the people's pockets that they can see. The water supplied from wells, of course, is more dangerous than that supplied to cities; and privies are more dangerous than cesspools, and cesspools more dangerous than sewers. There are two great questions relating to public health: How shall the water-supply be kept pure? and What shall we do with the water after it is brought into the cities? I think it may be assumed that there is no method of disposition of the refuse of large cities by dry removal; for the dry removal, if done well, is more expensive than sewers. The refuse of an individual is worth $1.50; to save it requires $3. No one will do this, unless he is convinced that in the long run he will save money by so doing. If we press these questions upon a community too strongly, without reference to locality, and without reference to the individual circumstances of the case, we shall fail.

There are certain streams that must be polluted. There are others that must be kept clean at all hazards. If we draw a line between the two, and allow a certain amount of pollution where it is necessary, and where the expense of doing otherwise will be more than that required to remove it, we shall be more likely to obtain our demands than if we press for a high standard. There are evils in connection with the pollution of streams that we cannot remedy until the people are raised to a higher standard of civilization.

But there is another thing which ought to be borne in mind: if we can lower the death rate twenty-five per cent., we shall save here 2,000 or 2,500 persons in a year; in a generation, 60,000 or 75,000. This may embrace some of the most useful men in the community, whose loss would be an irreparable loss to the community; but probably it will be a long time before we can make a community see that. The main object which I would like to call attention to is an attempt at some practical step for securing an improvement in the condition of our streams. It is necessary to move step by step; and, if we do so, there are certain points in which we can carry a community of manufacturers with us. There are a great many streams in the United States which are absolutely destroyed for purposes of manufacture. Paper manufacturers who make white paper require water of absolute purity; and the rivers in many parts of the country have become too much defiled for it to be possible to render that water useful, and the manufacturers have to filter it.

Then, again, it would be of comparatively little use for one State to take important steps, unless others do. For instance, a river in Massachusetts is polluted by the refuse of a town of 6,000 or 7,000 people, who do not use it as a water-supply. The river passes into the State of New Hampshire, and there they do not want to use it as a water-supply, and so the people of Manchester and Nashua pollute it. It then becomes one of the sources from which the people of Lowell and Lawrence get their water. A similar state of things exists with the river from which the people of Albany, N. Y., get their water. I do not know of any authority which can direct public opinion, and which can be better informed, or a better source from which regulations should proceed, than the State Boards of Health. There must be somebody, and I don't know of any that would have the confidence of communities to a greater degree.

I have prepared the sketch of a law embodying various points, as being the easiest way of placing the subject before your attention. It will occupy less of your time to state the different sections in order, which it is necessary to observe. As you probably know, the legislation of England has been directed to this point for twenty-two years. In 1855 the first laws were passed forbidding individuals from casting offal into streams. The law was not sufficient, and so a more stringent law was passed, which took effect in October. This law establishes a board whose decisions are final. These boards are local, and there is no appeal to the courts.

In the future, it seems to me, we can attempt more stringent legislation, and require that no streams shall be polluted by any source whatever, except under permission from recognized and constituted authority, whose decisions may be referred to a Supreme Court, but not to a jury. The first two sections relate to the solid matter. I think there can be no doubt about their importance. I refer final decisions to State Boards of Health; I hope the gentlemen from the several States will consider it in some way, because all the States must act together.

Dr. Folsom read the proposed law as follows: —

PROJECT OF A LAW TO PREVENT THE POLLUTION OF STREAMS.

SOLID MATTERS.

SECTION 1. No individual or corporation, and no authorities of any city or town, or public institution, shall discharge, or cause to be discharged, or knowingly permit to be discharged, into any public stream or pond in this Commonwealth, any solid refuse, including sawdust, ashes, cinders, etc., or any solid polluting substance, so as, either singly or in combination with other similar acts of the same party, or of any other party, to interfere with its volume or flow, or pollute its waters; *provided*, that such interference with the volume or flow of any body of water be not for the purpose of permanently narrowing or filling channels, streams, or ponds, with a view of making sea-walls or other improvements. But this prohibition shall not apply to liquids containing not more than two per cent. of solid matter in suspension.

SECT. 2. No public stream or pond shall be wholly or in part filled with solid matter for the purpose of making improvements, or for any other reason, in any city or town, without the written authority or permission of the mayor and aldermen, or of the selectmen of said city or town, approved by the Rivers Pollution Commission.

WATER SUPPLIES.

SECT. 3. No individual or corporation, or authorities of any city or town, or public institution, shall discharge, or cause to be discharged, or knowingly permit to be discharged, into any stream or pond in this Commonwealth which is used as a source of domestic water-supply, any sewage or liquid [illegible] human excrement, or any soiled water which has been used [illegible] over and above what is so discharged, without violating [illegible] at the time of the passage of this act: *provided*, such discharge [illegible] the case of running streams used as water-supplies, or emptying [illegible] used as water-sources, be within twenty miles of and above the [illegible] at which such water-supply is taken.

SECT. 4. No individual or corporation, or authorities of any city or town, or public institution, shall add, or cause to be added, or knowingly permit to be added, [illegible] organic matter discharged into any stream or pond in this Commonwealth now used for drinking purposes, within fifteen miles above the point where such supply is taken, or of refuse mineral matter within ten miles above said point.

SECT. 5. No individual or corporation, and no authorities of any city, town, or public institution, shall discharge, or cause to be discharged, or knowingly permit to be discharged, from any manufactory, house, or buildings of any kind established or built after the adoption of any pond or stream in this Commonwealth as a source of domestic water-supply, any refuse matter into said pond or stream within twenty miles above such point of water-supply, — and beyond that distance, no refuse matter until it shall have been cleaned or purified in a manner satisfactory to the Rivers Pollution Commission. This prohibition, so far as is not provided for in preceding sections, shall not apply to now existing pollution of present sources of water-supply.

SECT. 6. No individual or corporation, and no authorities of any city or town, or public institution, situated on or near any pond or stream in this Commonwealth, hereafter used as a source of domestic water-supply, shall, from that time forth, increase, or cause to be increased, or knowingly permit to be increased, the amount of refuse of any kind, including effluent water from manufactories, towns, sewage-works, etc., discharged into such pond or stream, unless with the approval of, and in the manner prescribed by, the Rivers Pollution Commission.

STREAMS NOT USED FOR WATER-SUPPLIES.

SECT. 7. No individual or corporation, and no authorities of any city or town, or public institution, shall add, or cause to be added, or knowingly permit to be added, to the amount of refuse or polluting substance discharged into any public pond or stream in this Commonwealth, without the written permission of the mayor and aldermen, or of the selectmen of the city or town in which said discharge is intended, and with the approval of the Rivers Pollution Commission; and it shall be in the power of said mayor and aldermen or selectmen, with the approval of the Rivers Pollution Commission, to prescribe under what conditions, where such are deemed by them necessary, any polluting substances may be allowed, in any given case, to enter a pond or stream.

WATER-SUPPLIES, DRAINAGE, AND SEWERAGE.

SECT. 8. In cities and towns supplied with sewers, said cities and towns shall allow the sewage of manufactories to be discharged through the public sewers: *provided*, such sewage contain no poisonous chemicals, and no substance injurious to the structure of said sewers, or causing such obstructions in them as can be remedied only by means not necessary for ordinary sewage, — no steam, gases, or any matter injurious to the public health when discharged into the sewers, and no matter which will injure the value of the sewage, or otherwise render more difficult its disposal at the sewer-outlet. No one of the above-mentioned substances shall be discharged into the sewers without the consent of the local authorities, and by approval of the

Rivers Pollution Commission: but, with such consent and approval, manufacturers may be allowed to discharge into the sewers matters not injurious to their structure or prejudicial to the public health, upon payment of such damages as said authorities and the parties concerned may agree upon.

SECT. 9. No town or city or private party shall introduce any sewers or any system of public water-supply or sewerage until their plans shall have been approved by the Rivers Pollution Commission; and no dams shall be built upon streams in the populated parts of towns or cities without the approval of the Rivers Pollution Commission.

SECT. 10. In any city or town where public sewers have been built, the local Board of Health, with the approval of the Rivers Pollution Commission, may order any privy or privies to be abolished, and connection to be made by the owners with the public sewers, in the manner and under the penalties so prescribed in chapter twenty-six of the General Statutes; *provided* said sewers are not more than one hundred feet distant. And, where such connections are made, the local Board of Health may require it to be done according to such regulations as they may deem necessary for the safety and health of the people. The Rivers Pollution Commission shall furnish copies of proper regulations when requested to do so.

PROHIBITIONS IN CASE OF NUISANCES.

SECT. 11. The Board of Health of any city or town may prohibit the discharge into any stream of human excrement, or the waste-water of washing clothes from mills or tenements belonging to them, under penalties, and in the manner prescribed by chapter twenty-six of the General Statutes with regard to nuisances.

SECT. 12. Whenever any serious offense exists from the pollution of any pond or stream within the State, the Rivers Pollution Commission may, if in their judgment the public health or the public comfort and convenience shall require, order any person or persons, other than the authorities of any city or town, to cease and desist from such pollution, or to cleanse or purify, by means satisfactory to said commission, the polluting snbstances before being cast into said pond or stream: *provided*, that on any application to said Commission to exercise the powers in this section conferred upon them, a time and place for hearing the parties shall be assigned by said Commission, and due notice thereof given to the party against whom the application is made; and the order hereinbefore provided shall be issued only after such notice and hearing. In all such cases, the Rivers Pollution Commission shall consider the reasonable practicability of a remedy, as an important element in rendering their judgment. In complaints against cities or towns, said commission shall recommend, when desired to do so, some plan for adoption, and shall advise the complainants as to the best course to pursue.

PUBLIC BUILDINGS.

SECT. 13. All public buildings hereafter put up or occupied by the State must have their plans of water-supply, drainage, and disposal of sewage approved by the State Board of Health, before they can be adopted. Said

Board shall also examine the water-supply and drainage of the various public institutions, and report what, if any, changes should be made in these respects.

FORMAL PROCEEDINGS.

SECT. 14. Any party feeling aggrieved by any decision of the Rivers Pollution Commission in accordance with the provisions of the preceding sections may appeal to the Supreme Court for revisal or modication of such order or orders.

SECT. 15. Any person or persons violating any of the provisions of this law shall forfeit a sum not exceeding four hundred dollars for every month he or they continue to act in violation of said law.

SECT. 16. Complaints for the violation of this law may be made by individuals, corporations, authorities of towns, or local Boards of Health.

SECT. 17. The Rivers Pollution Commission may, when in their opinion it is necessary. before giving their approval of any plans of water-supply or sewerage, employ a civil engineer of experience, and of eminence in his profession, to make the requisite examinations ; and the expense of such consultation shall be borne by the city or town to be benefited thereby.

SECT. 18. The Supreme Judicial Court, or any one of the justices thereof in time of vacation, shall have power to enforce the provisions of this act.

SECT. 19. This act shall take effect on the first day of January, eighteen hundred and seventy-nine ; and all other acts and parts of acts inconsistent therewith are hereby from that date repealed.

Q. (DR. BAKER, secretary of the State Board of Health of Michigan). Would it be possible to secure copies of the document?

A. (DR. FOLSOM). It is not in print yet ; a great deal of it is in pencil and poorly written. I shall have copies printed in two or three weeks.

I would like to say that the State Board of Health have been requested by the Legislature to act upon it at the next session. At the present stage the draft itself is simply my own work. The Board has no responsibility for it, and do not in any way offer it as a law. My chief object in reading it was to introduce the general subject; and it seemed to me that could be done without publishing it in the daily papers. I expect to have it published in a week or two. It seems to me that if the Association had it before them in detail to-morrow, they would not be ready to accept or reject it. I do not think there would be many gentlemen whose opinions would be formed in that time. I would rather a committee of the Association should be appointed to consider the subject, but not to report until, possibly, another year. It seems to me the investigation should go on on this line.

DR. AMES. — If I understand Dr. Folsom aright, it does not seem to be a matter of haste. A reference to a committee would give full opportunity for all sections of the country to have considered the state of progress which has been obtained. While I am clear that the law presented by Dr. Folsom would, without any particular change, be applicable alike in Massachusetts and Michigan, and perhaps in New York, yet there are States whose progress in sanitary matters has not been sufficient for them to take that law and make it effective. Therefore, let us have a committee to give a year's deliberation to it. A year is not too much. We should then get a report which would adapt itself to the interests of separate sections. I hope some such consideration may be given it.

A MEMBER. — My idea is not to put this off for a year. It should be reported before this meeting adjourns. As the gentleman says, it would not apply to Illinois as well as Massachusetts; but the committee could revise the act so that we could take action upon it at the next meeting.

DR. HITCHCOCK, of Michigan. — Dr. Folsom has presented a paper which is an egg to be incubated. We must not make too much haste in the incubation. This Association may say it ought to be incubated, it ought to be hatched; but there are various States incubating. We, in Michigan, would be glad to incubate the egg well. Possibly the chicken might be altered in Michigan. So, it seems to me that we had better not be in too much haste to say we have hatched the egg.

TUESDAY EVENING, SEPTEMBER 25.

[C.] *Atmospheric Impurity and Humidity, Wet Ships, etc.*

DR. N. S. DAVIS, in the chair, said: I wish personally to welcome those who have come from abroad to this place — a place favorable not only for the discussion of papers, but for the actual study of Sanitary Science and Sanitary Measures. It is twenty-eight years this month since I found my way to this city; and I well recollect at that period of time they were just in the act of constructing a sewer from the main trunk of the river southward, one block — from the river to Lake Street, and they were constructing it of plank in triangular form. And some gentlemen had caused South Water Street to be excavated two and one half feet, and laid with plank at the bottom; and Randolph Street also. The ground was a little lower towards the centre, so that the water would run off, thus making a street and sewer at the same time. There were about thirty thousand people here then. There were not six brick or stone buildings in the place. Now, the changes that have taken place are such as you have heard detailed to-day by the city engineer; and you have learned from various other sources the changes through which the city has passed from that early beginning down to the present time, with its tunnels under the lake, and tunnels under the city; with its abundant supply of water; the means that have been resorted to to purify the river, and the method of constructing the sewers. If the object was to learn from our mistakes, it would afford a fertile field of study for sanitarians, if they should spend at least a month here; or, if you turn to the other side of the picture, and study what are not mistakes, I hardly know of any place on the continent that would be equally interesting as a subject of study.

But my object was only to greet you and to express the hope that your meeting may be, in all respects, a profitable one, for I am sure there are no persons in the world more interested in sanitary science than the medical men and the business men of Chicago, the men who carry on trade, and who have planted here a future million of people upon this, what was originally a low, uninhabitable prairie, and have made it the beautiful city that it is. Hence there is every inducement for us to cordially greet you, and to hope not only that this may be a profitable meeting, but that many gatherings may take place in the future, until much is accomplished in the interest of humanity.

PROFESSOR HOSMER A. JOHNSON, of Chicago, then read a paper, comparing the results of study and statistical records of phthisis pulmonalis in the northwestern and northeastern States. This paper has been reserved for further studies after the next national census.

DR. THOMAS J. TURNER, Medical Inspector U. S. Navy, then read a paper upon Air and Moisture on Shipboard, which elicited discussion as follows:[1] —

DR. A. L. GIHON, Medical Inspector U. S. Navy, said: —

As Dr. Johnson did me the honor of quoting me with respect to the influence of humidity as one of the causes of phthisis, it is perhaps right that I should say something. Naval medical officers naturally feel some reluctance about including their observations with regard to general disease, because their opportunities for observation are few. But in this particular case this fact gives them a certain value. The naval medical officer is rather a sanitarian than a healer. It is his duty to keep men well. He has charge of certain little communities, presumably of entirely healthy men; and if, under certain conditions, diseases are induced, the inference is justifiable that those diseases have resulted from those causes. Every man and officer of the navy is carefully examined. The first thing that the young medical officer is taught is how to examine the men. Every officer or man is officially examined, and if particular attention is paid to one part more than another it is the thorax. Nevertheless it has been observed for years that perhaps the most common disease on board ships is some one of the diseases of the lungs. For many years these diseases were attributed to undiscovered inheritance; and many a poor fellow has been discharged from the service, and been refused a certificate entitling him to a pension, because it was assumed that his disease of the lungs must have been inherited — that he could not have contracted it on board ship. But after a while, when we began to measure the lungs, and record in each case the utmost expansion of the chest by spirometric measurement, it was noticed that many men who had the largest spirometer measurement were subject to pulmonary disease. It is true that our statistics are small; but this is due to the fact that the men are discharged at the end of the period of enlistment, whether sick or well; and the probability is that a large proportion of the mortality statistics of the Marine Hospitals is due to diseases which originated in the navy. Now, it has been known from all time that wet ships are unhealthy ships, and conversely that dry ships are notoriously healthy. There is an instance in the life of Admiral Collingwood, where with a crew

[1] See Dr. Turner's Paper, on pp. 103-115.

of eight hundred men on his flag ship, after a cruise of a year and a half, he had only four sick persons. He scarcely ever allowed his decks to be wet. But it has been the custom, and still is the custom to deluge every ship in the service, every part of the deck, at least, every morning. Recently, since we have been making these investigations, and measuring men with reference to the thorax, and have discovered so many well-formed men who have had phthisis, we have discovered that in these wet ships the disease is largely in the ascendant. . The conclusion is that it is damp air which produces this disease. Medical men in our own country are unanimously of the opinion that the persistent breathing of damp air is the cause of pulmonary disease; and not merely damp air, but damp foul air. It is doubtful whether mere damp air is deleterious, for in every case in which we have noticed the phenomena there has been a mixture of nitrogenous matter. The ratio of cases is greater in the damp months of the year. As Dr. Turner states, the probability is that dampness is only one of the factors in the cause of the disease.

WEDNESDAY MORNING, SEPTEMBER 26.

[D.] *Sanitary Influence of Trees.*[1]

DR. HARRIS. — The question of the utility of special kinds of trees separately considered, or the larger question which Dr. Andrews has opened before us, whether we should not try to prevent the forests from being cut from all sections of the country, are plain questions. Where the soil is unfertile they have certainly left a silent voice in their own behalf for their preservation, as not only objects of natural beauty, but as conservators of the purity of the atmosphere. In the Northern States, the fact that the forests have been so greatly denuded from districts once remarkably healthy, and that these districts have suffered from special epidemics (I refer to diphtheria in certain denuded districts of New York, which I have not noted), the fact that over extended districts of populous States we find the forest lines have been denuded to an extent that the whole country, for hundreds of square miles, has been put to certain inconvenience, to say the least, and that this region has been visited by epidemics that, however in[illegible] dependent upon special [illegible], nevertheless assume so much of [illegible] characteristics in those localities, is a matter of vital importance. Upon Long Island, many years ago, back to the earliest history of the white population of the district, a large area was known as waste — the Hempstead [illegible]. A few years ago the property was bought at forty-seven dollars and [illegible] per acre. It is now laid out as a town, but not entirely built up. [illegible] a hundred dwellings — very fine ones — have been erected there[illegible] being owned by a single property-owner, Mr. Stewart, no [illegible] would be most desirable for human habita[illegible] [illegible] trees were planted — some a foot in diameter. Very [illegible] a very barren plain, these trees have, almost without

1 See Papers by Dr. Andrews and Professor Brewer, pp. 31–43.

exception, survived something more than three years. They are extremely beautiful. Trees have been planted, first by the side of wide avenues, extending over twelve or fourteen square miles. Streets are laid out, and trees planted by the intelligent use of wealth, in anticipation of the use of the property for human habitation. Several park grounds have been planted in the centre. I speak of it as illustrating a new departure in the way of providing for human health. One of the facts concerning these trees is that the whole expenditure of replacing trees upon the grounds (though we do not know when trees ever existed upon that ground) is so small comparatively, that it furnishes a strong argument in favor of tree planting. Fortunately the State of Illinois has got several illustrations of right earnest advocacy of this practice. I merely say this to advocate the question, and to lay before you the paper of Mr. Brewer, which is full of valuable information.

Dr. Churchill, of Galesburg, Ill. — I come from Bureau County, Ill., and live in a prairie country. In 1839 I came to Galesburg, Knox County, on the summit between the Illinois and Mississippi rivers. The prairies there are very extensive. It is true we once had a large forest skirting the Harrison River, which flows into the Mississippi. The prairie was some seven or eight miles in width, extending to the southwest, to Quincy, perhaps. During the first fifteen years of the settlement we had plenty of rain along the forest belts; but on the prairies mostly no rain except in the spring and fall. This large forest has been almost entirely removed, and the ground occupied by farms, while the farmers on the prairies have planted trees extensively. The result is that it has materially changed the rain-fall over the prairies.

Suggestions relating to Causation of Diseases.

Dr. N. S. Davis addressed the Association as follows: —

The sole object I had in view in promising a short paper here was the hope of directing attention of the members of this Association, as well as others, to what I deem an exceedingly important line of investigation, that has only just been begun comparatively. It is very evident to all of you that before we can make rapid progress in our work of preventing disease, we must be able to see clearly and distinctly the essential causes of the diseases that we propose to prevent. Hence, the first step in the investigation of all sanitary matters, one of the more important steps, is to ascertain as clearly and definitely as possible what are the essential conditions on which the development of any disease depends. Now, I do not mean that we must go out to find the identical thing, if there is a poison, for instance, or a germ; but we must go so far as to get at the essential conditions out of which the disease arises or the immediate essential cause is developed, else all of our arts and devices and remedies will be more or less blind experimentation. But just so far as we can bring the knowledge to bear so that we see clearly just what are the conditions accompanying the development of the disease, then we advance logically to the investigation of how far we can control those causes; for so far as we can control the conditions we control the development of the disease.

Many years since, in pursuing this general subject of etiology, I came to be impressed with this fact, that nearly all our statistics are statistics of mortality. They tell us when the members of the human race die, and how many in a given time. But they do not by any means tell the date of the beginning of the disease which produced death. To know how many die in a given month or year, of each class of people and of each disease, does not tell us at all as to the conditions of the atmosphere, or any other of the surrounding circumstances at the time of the origin of the disease. For instance, to go directly to the subject of investigation, all bowel affections of children commonly known as summer complaint, including the ordinary diarrheas of summer and cholera infantum, — statistics of mortality show clearly that these diseases commence regularly with the access of the warm weather of summer. Generally they begin in June in this latitude. Usually, during the months of December, January, February, March, April, and May, in this city, the statistics of mortality will not give you an average of three deaths from bowel affections — that is, cholera infantum or diarrhœa. When June arrives you will have 10, 15, or 20 from that class of diseases. July will give you 200 in round numbers, generally more than 200; August will give you about 200 more; September, 150; October about 50, and November about 25. I speak now in general terms. The statistics, so far as they appear in the paper, will be accurate. This is merely an illustration.

Now, if we were to infer the causation from the mortality list, we would infer that the causes of bowel affections in children commence to be operative in June, are strongly developed in July, hold about the same causative force in August, diminish visibly in September, more rapidly in October, and disappear substantially in November. This would be the inference. And it has come to be the general inference that in these diseases of ordinary diarrhea and cholera infantum, that sweep away so large a number of our infants each year, not only in the cities but in the smaller towns, through the middle and northern belt of the United States (not peculiar to cities), — the general causation is operative during the entire warm season of the year. This is the general impression.

A few years ago this query came with great force as to whether it was true that the causes which originate this disease were equally operative through the summer. When the Signal Service Bureau was established, and we began to have observations of the meteorology throughout the country, it occurred to me that if we could link along with these meteorological records observations as to the ozonic and electric conditions of the atmosphere, we would have a very complete record of the atmospheric conditions. Then, if we get good physicians in active practice to begin a series of carefully observed records, as to the actual date of the beginning of all acute diseases that come under their observation, to pursue the inquiry diligently and not be bluffed off, we increase the value of our statistics. Here I want to make a remark. For instance, take the subject I have in hand. You are called to a child with the cholera infantum, or the child is brought to you. You wish to know the date of the beginning of the disease, — the first incipient beginnings of the bowel trouble, — in order to compare the meteorological conditions. You ask the mother, "When did your child begin to be sick?" She will generally tell you "Two or three days ago." "But was that the beginning?" She will say it was. You will be turned off two or three times, and if you are easily satisfied you will be led to date the sickness entirely wrong. You have to question closely and explain what you mean. You will frequently find that the child brought to you to-day with the assertion that it began to be sick two or three days ago, has been beginning its bowel affection for three weeks. The mother only dates the sickness when it goes to bed. I make this remark to show that if we would have accurate statistics we must make inquiries closely to get at the real facts.

I endeavored to get the Signal Service Bureau at Washington to add these two items so as to make the meteorological observations of service to the medical profession in the investigation of disease. Usually, in cases of epidemic like cholera infantum, or yellow fever, we wait till the epidemic comes, and then begin to make observations. And the observations cease as the epidemic disappears. But taking observations when the epidemic is present gives only a partial view of the facts. If we have these records complete we are prepared to state the origin of the disease, and compare the meteorological conditions with the date the disease starts, and so we are able to see whether there is anything peculiar in that particular time. Thereby we get at an exact knowledge instead of loose generalization. In pursuing this investigation, to see whether it would be practicable to attach these observations to the bureau, I was informed at the time that it would be practicable to do it, but it not being done I infer that it was found that these observations could not be added without too much difficulty.

Now, to hasten the matter, I have said, if you take the statistics of mortality, you infer that the causes of those bowel affections are operative all along through July, August, September, and slightly in June, and more slightly still in October. I commenced a series of records as early as 1850, during the cholera season, but more particularly with reference to these meteorological statistics in 1874, and out of many promises I succeeded in getting practitioners at Omaha, in Davenport, and at Cairo, to keep the records for 1874, 1875, and 1876, as to the date of the beginning of acute diseases; and with what result? The result in detail I communicated to the American Medical Association, at its recent meeting in this city. That paper will be in the Transactions; hence, I need not repeat it here. The conclusions were that the commencement of bowel affections, diarrhea, and cholera infantum was uniformly, and with as invariable a degree of exactness as any other law of nature, in the first week of consecutive, steady hot summer weather, no matter when that week may come, I should say from five to seven days of steady, consecutive, high temperature, day and night (not merely during the day with cool nights). I think, in 1875, the highest range of the thermometer in the entire year was early in June, when it arose to about 95° or 96°, and the next morning it was down to 50°, and there were no bowel affections. No case was reported. But later in the season, in the same month, there commenced the first steady wave of warm weather. In 1874, as an illustration, the first wave of high temperature commenced on the 17th of

June, reaching its climax on the 25th of June. The thermometric range from the 17th to the 25th was 72° Fahrenheit at night, and 92° during the day. There was a continuation of heat night and day. The thermometer at night did not go below 72°, nor in the day-time below 92°. Now, just as certainly as you get five or six days of continuous hot weather during the first week of July, or the last week in June, just as certainly these bowel complaints commence. This will strike you as remarkable. As you go on with your observations, you will find patients weak and emaciated in the last of July or August, who commenced the first looseness of the bowels that very first week. Now the next wave of high temperature was the week ending the 11th of July. The third wave was the week ending July 25; and all of the cases of bowel complaints that occurred in this city, as indicated by those that were registered, had their origin in this city, in Omaha, in Davenport, and Cairo (three fourths of the entire number), during these weeks when the thermometer stood at 70° or above continuously, and reached the most of the time, during the day, from 90° to 95°.

Many have the idea that it is sudden atmospheric change that produces these diseases; but suddenness of change never gives rise to cholera infantum or serous diarrhea. Suddenness of change will convert many cases into dysentery, and give rise to dysentery; but I have never found cases of cholera infantum commence at such a date as to indicate that they were originated by sudden change from heat to cold. On the contrary, sudden change from high temperature to cold checks these diseases; so that the result of all these observations is this: Four fifths of all the cases of cholera infantum and ordinary diarrhea originate in a small compass of time, and that small compass of time is embraced in the particular seasons or waves of high temperature that continue steadily night and day; and if the air is still the effect is very much more intense. Four fifths of the cases that will be attacked during any summer will be attacked during the last part of June or early in July. A few only will commence in August. But you will find this: through August the mortality will be nearly as great as in July, because the larger portion of these attacked in July do not perish until August. And all through August, when you get two or three days of steady, successive hot weather, day and night, you will have abundant relapses. You will find a large portion of those attacked originally in July, and partially recovered, to be relapsed by this period of high temperature in August. But very few absolutely new cases occur in August, and in September the new attacks are still more rare, and October none. In all the places where these observations were made (and the records covered the entire year) there was not one case that originated anew in the month of September. At Omaha there were reported two or three cases originating at a period of high temperature in May.

If these observations are correct, and I think them entirely reliable, if this peculiarly destructive form of disease to our children begins with the simple development of continuous, steady, high temperature, then we have a good point at which to begin our measures of prevention. In the first place, we are able to calculate the time beforehand, and so get the children into the country. When shall we send them away? If we wait until July or August we may help them to recover, but we shall not save them from attack. If they are going to be attacked they will be attacked before that time. They must go before the first wave of continuous high temperature appears. Suppose you advise your patients to be taken upon the lake or ocean, when should they start? After the disease has developed and after the children are sick? The people should be taught that, to make the work effective, they should take the children away at once. It will be said, I know, that we cannot make the common people move till they are sick. That I admit; we cannot influence the large mass; but there are other inquiries, as, whether there are no means to be brought to bear that will counteract the effect of continuous, steady high temperature day and night upon the sensitive nervous system and alimentary canal. Is there nothing that can be applied at their homes? Can we not devise preventive measures otherwise? It seems to me that if this rule that I have laid down as to the conditions giving rise to these diseases are correct, then we may give to the more intelligent part of the population, and a great part even of the less intelligent of the laboring class, a knowledge of appliances that they may adopt in their own houses. In the first place, they could be taught to take more pains during the hot, sultry nights; for you will find that most of these cases begin between midnight and daylight — the last half of the night. It is just the same with cholera. In going through five epidemics of cholera, it came to be a matter of clear and distinct certainty that a large majority of cholera cases have their beginnings between midnight and daylight. Every physician practicing in the city knows how he is drummed up in the early morning to this one, that, and the other.

I want to suggest this; that while we should pay more attention to ventilation, be more careful that we do not keep the children in an atmosphere rendered impure by confinement, I am inclined to think that a large amount of this disease could be prevented by a simple practice, such as that whenever the time comes to put the child to bed, in the summer season, with the thermometer at 70° or above, the child should have a cool bath to give tone to the system, tone to the vaso-motor apparatus, and lessen the caloric a little; or, as a substitute for that, the child should have a cold, wet bandage wrapped around the trunk. Either of these modes, by abstracting one or two degrees of caloric, and carried on every night when the temperature comes up, would protect thousands of our infants from these attacks.

I know many are incredulous as to the high temperature being the exciting cause. I will not pretend to decide that point. What I know is this, that whenever a city or town is so located that it has cool nights through the summer season there is little infant mortality. Take San Francisco, for instance, — in the same belt of latitude that we are, but on the Pacific coast, — where they have cool nights during the summer, and where the thermometer may rise as high as with us, yet in the night-time uniformly more or less cool: there there is little infant mortality, — hardly enough to attract attention; I mean from bowel affections. Go to Key West, and you will find the same thing prevailing; and so wherever the location is such that there is but small range between summer and winter, and where through the summer the nights are cooled by the sea breezes. But where the contrast between the extremes of winter and summer is great, where you get several days of hot, stagnant, still air, there you will have a development of this class of diseases; and the more intense and prolonged these meteorologic conditions, the more numerous the attacks. If you say high temperature alone is sufficient, you have said what I have said. I would not have you infer that it is this alone that produces it. There is more or less impurity of air; but these phenomena of high temperature, in a locality subject to wide extremes between summer and winter, constitute the conditions. Whether these conditions come directly by electric or ozonic states of the atmosphere, so that the vaso-motor nerves are in a depressed state, coupled with a sensitiveness of the mucous membrane, and consequently relaxed by added caloric and lessened vital affinity, I do not know. But I know that when you do away with the conditions you do away with the disease.

The world has been busy many years with the idea of trying to find out what caused fever and ague; but I do not know as we have found what the disease is yet. We have found the conditions out of which it is developed, and we are able to devise means to counteract it. So, if we can proceed so far that we can exactly put our fingers upon the conditions of a disease, then we can say whether they are subject to our control, and how far. Knowing the atmospheric conditions that are calculated to develop the disease, children could be moved away, — some to the mountains, or to the floating hospitals; and those that must stay at home could be treated with a cool bath or cool pack, and to improved ventilation; and in this way, my opinion is that we could lessen the infant mortality more than one half in five years. And who will not say this is an object to be sought after, when, taking the gross mortality, almost one half of all the deaths are of children under two years of age; and in all cities and large towns, of this half, one sixth are caused by these bowel affections, that literally sweep, every summer season, so many infants into their graves.

Dr. Harris. — Any provision that will secure a cooler and purer atmosphere to little ones during the summer, in periods of excessive heat, is a means of diminishing one half the total cases of mortality. This seems to be warranted by what we observe in the immediate vicinity of large cities, in open and cool localities; and in the cities, as they grow larger, this is the problem of humanity to be undertaken as a special duty. In the city of New York it is a difficult problem. In the city of Chicago it is less difficult. Here the lake is at the right hand and the left. With such facilities, Chicago may have the opportunity of trying an experiment which is difficult in cities by the sea-side. During the summer months, by just passing beyond the cities into the cool, rural regions in Westchester County, or in New Jersey, and away from malarial districts, the little ones may be saved. Often by going no farther than the plains of Long Island, beyond the smoke of the city, we see whole communities and hundreds of dwellings without the death of a little one in the entire summer. I can speak of eighty-one dwelling-houses upon contiguous grounds, some twenty miles from New York, in which there has not been a death of a child during the six months, though there were numerous small children in those dwellings.

DR. HAMILL, of Chicago. — I have made some observations with regard to pure air. We have had more than a hundred children for a period of time at the Floating Hospital; and repeatedly I have noticed children brought to the boat, and by the time we reached the Hospital Boat they would have their heads erect, and within one hour would be calling for something to eat. A little patient that had gone beyond my reach I thought would certainly die; but by a great deal of difficulty I got the mother to take it to the Floating Hospital. In twenty-four hours the child had improved beyond belief — simply from the effect of the air upon the lake. From observations I have gathered, the great importance of such remedial means has been very strikingly shown. We use no medicine at all. We rely upon a pure milk diet.

DR. LYMAN, of Chicago. — I wish to indorse the propositions so ably set forth by Dr. Davis. I think many of us are apt to be so affected by the words germs, spores, miasm, and such intangible things, that we are apt to neglect the tangible facts before us every day. As has been said, it is the easiest thing in the world to trace the connection between the variation of temperature and the causation of disease, just as it is easy to trace the mortality of other diseases. I think physicians who are not in the habit of using a barometer and thermometer lose a great deal of pleasure in the practice of medicine; for though I have not made as extensive observations as Dr. Davis, still my observations go to confirm the positions that he has advocated, so much so that I can anticipate with a great deal of confidence precisely what will be the character of the cases for the next twenty-four hours. The remark that Dr. Hamill has made, with regard to the effect of cool air upon children, is capable of being emphasized more in this city than in any other place I have been in, owing to the fact that the proximity of the lake gives exceeding sudden changes of temperature. It is delightful to see the effect of such cool breezes upon the children. Of course all this does not exclude the possibility of malaria, miasm, and a great many other intangible factors, as being active agents in producing disease.

A MEMBER. — I would like to inquire of Dr. Davis, whether he has made any observations on the temperature of the blood, and whether he connects the mortality of infants with any definite rise of the temperature of the system. If the temperature of the atmosphere were 70° above for some days, as a natural consequence the temperature of the system would come up to what might be a dangerous height for children. If the temperature of a child rises to 102° or 105°, and remains for a while at these heights, there soon arises danger of heart exhaustion. It may be possible (I do not know whether observations have been made or not) that a tender infant will not bear as high a temperature of blood as the adult; and it may be that the temperature operating upon the infant produces disease. If so, the indications, of course, will be some means to reduce the temperature and thus save the child.

DR. DAVIS. — I have not had opportunities for directly measuring the temperature of the blood in these cases to a large extent, because during the last few years and no doubt it will be found so in practice by most persons very few of these patients, compared with the whole number, are brought to the physician immediately. There are large numbers that we do not see for weeks after they are first taken ill. I could not speak of the degree to which the temperature is elevated. But the influence of high temperature acts in more than one way upon the human system. It is not merely by the additional number of degrees of heat added to the body, but in a rarified air above the common temperature, varying between 70° at night and 90° in the day-time, there is a considerable difference in the amount of oxygen the patient receives. The arterial blood is less supplied, and if the air is filled with moisture, the evaporation from the pulmonary surface is lessened, and thus the means of taking up caloric is lessened. I have no doubt at all but the temperature is, as an infallible rule, increased; but just what degree of increase will be borne without producing disease I have not made observations enough to draw inferences. There is an increase of heat, but its effect on the tone of the system, on the arterialization of the blood, the elimination of waste and carbon from the lungs, and its influence in lessening the control of the vaso-motor nerves over the capillaries of the system, so as to favor fluxes and congestions, cannot be easily measured. There is no doubt at all that the tissues are all more or less diminished in their tone, by high temperature. The addition of caloric removes the particles of matter and increases the volume in live as in dead matter. Additional degrees of caloric diminish the affinity of atom for atom, and consequently relax the tissues and render them less capable of resistance. Thus you put the condition of the patient just right for flux or exudation. I think that the cool air does not operate merely by abstracting the excess of caloric where the cool bath or the wet sheet is used, but it comes from actually increasing the efficiency of the nerve force, and thereby restores its influence over the system and over the molecular changes that take place.

Speaking of the effect of cold air, I shall always remember, as vividly as anything that I ever remembered, the cholera season of 1854 in this city. It was one of the most severe cholera epidemics we ever had. It culminated in the middle of July. It had been lurking along through the months of April, May, and June, but during the last half of June it increased till it culminated in a sweeping epidemic. There was no sign of any abatement. It left the low places, left the by-places, and was sweeping over the avenues with almost as much virulence as any other places of the town. One afternoon I was on my way down Michigan Avenue towards what was then old Fort Dearborn to look after one of the best citizens, when all at once a sort of shrug came over me, — I was bathed with perspiration, and, all at once, there came a cold streak just as definite as if I had stepped from a hot bath into a cold one. The next thing I noticed was a rustling of the leaves. A wind from the northwest was sweeping down here, and in a little time the warm atmosphere was swept out of the city by a fresh, cool breeze. The next day showed a diminution in the number of cholera attacks, and from that day was dated the climax of the epidemic. We had other warm days and a good deal of cholera after that, but the force of the epidemic was broken, and it began to decline until it entirely disappeared. I do not say the temperature was a cause of the epidemic, but speak of it to show what its influence was in this city.

DR. STEARNS, Health Officer of Milwaukee. — A majority of the children who die of bowel complaint are artificially fed. It is known that human milk is unlike cow's milk, and so the chemical physician goes to work to make milk that will correspond to human milk. He reasons that there is more sugar in human milk, and puts in cane sugar; but it is not cane sugar that is wanted. I cannot see the propriety of making something that corresponds to human milk. My observation is that cow's milk alone is better than an artificial compound. In cities you get milk. When this is too strong, it must be watered. The milk having been watered before, it reaches the family in the single can from the mythical one cow of which we have all heard so much. The result is that the child dies of inanition. My practice has been to enjoin milk as soon as the child is old enough; and not to make any artificial compound at all, because you get something that will sour in the child's stomach.

Treatment of the Needy Poor.

PROF. EDMUND ANDREWS, of Chicago, then read the following paper, to open a discussion: —

The more common medical and surgical diseases of the poor are provided for by public charity, with a reasonable liberality; but there is one group of surgical affections which is still treated with the grossest neglect, and which by sheer want of attention consigns thousands to deformity, disability, and pauperism.

This group consists mainly of the joint diseases.

The cases have a history much as follows: —

A. B. is a laborer's child. By the mere occurrence of some fall he gets a slight inflammation of one or more vertebræ. Nothing is known or thought of it until it has advanced to the stage of softening and of incipient Pott's deformity. He is now taken to a physician, and receives some advice, but nothing more. The disease can be cured with great certainty at this stage by a good spinal supporter; but the apparatus costs from $25 to $40, and the parents are unable to order it. The disease progresses, and the child becomes a debilitated and discouraged humpback. As he grows older, he feels the shame of his deformity and the difficulty of subsistence, and by combined physical weakness and mental discouragement gradually sinks into the ranks of pauperism.

C. D. is a laborer. A blow on the knee has inflamed the joint. Simple rest would cure it; but it is not easy for him to subsist without laboring, and he goes on at his work until the grinding and friction of the inflamed surfaces of the joint produce chronic degeneration of the articulation. He is still curable by a proper brace, combined with other treatment; but the brace costs from $15 to $25, and he no longer has the means to pay for it. The perfectly curable knee at length by sheer neglect becomes carious and bent and anchylosed, or else is amputated; and the man meantime has become permanently pauperized. Similar results constantly follow from diseases of the hip and the ankle, and, in short, from any chronic surgical case which requires some expense of apparatus for its cure. The patients cannot bear the expense, and the authorities decline to do it for them, and thus thousands are brought to the almshouse. Here is economy with a vengeance. To save fifteen dollars, a man is made a permanent pauper, and costs the public two or three thousand dollars before he dies.

This class of cases should receive prompt aid at the very outset of their diseases; and, when needy, the public authorities ought to furnish the required apparatus. It would be easy for the officials to make contracts by which they could procure the instruments at considerably less than the ordinary cost, and they would save money immensely by stopping such cases of disease at the beginning of their career. Large numbers of these patients are children. It is pitiful to see them gradually broken in health, distorted in person, and ultimately, after years of discouragement and suffering, landed in the poorhouse. These things ought not to be in a civilized community.

Apparatus alone, however, is not sufficient. The best surgical skill should be employed which could be found in the hospitals and dispensaries, or by contract with surgeons who have given attention to orthopedic treatment.

I have for several years endeavored to simplify and reduce the expense of orthopedic apparatus, so as to place it within the reach of the poorest; and to some extent I have succeeded, but it is not possible to bring it low enough to enable the utterly destitute to buy it with their own means. Public charity must meet the difficulty.

Another preventable cause of pauperism is hernia. There are numbers of cases where the mere want of a good, well-fitting truss has led on to an enormous hernial tumor, which becomes a permanent disability. Trusses are often furnished by the authorities, but generally in such a blundering way that the articles procured are worse than useless.

In the large cities it would be perfectly easy to rectify this neglect. The only difficulty would be in the remoter counties, where the physicians are not well acquainted with the use of the apparatus, and have access to no competent instrument-makers; but this obstacle can be overcome. The more common forms of joint and spinal diseases require only six kinds of apparatus in all. It would be easy to prepare a small treatise, with illustrations and directions, which should be so simple and clear that any ingenious village surgeon could get what was necessary constructed by neighboring locksmiths and other mechanics. However, it is not every educated physician who is sufficiently master of orthopedic and hernial surgery to render him competent for the care of these cases. It requires some special surgical skill and ingenuity, but not more than can be found in or near every well-populated county. This work should not be committed to bunglers, but placed in the hands of the best men, and it will be found that the best work of the best men is the cheapest, when applied to the object of preventing the consignment of men to a life-long residence in an almshouse. The limping of pauperized cripples and deformed persons around our streets, who ought to have been cured at the first onset of their diseases, is a disgrace to our civilization, and, now that orthopedic surgery has reached such an advanced state, is utterly without excuse. Humanity and economy alike require a better attention to this important subject.

DR. CHANCELLOR, Secretary of the State Board of Health of Maryland. — I must begin by stating that if I will not attempt to enter into any discussion of this question after the very interesting paper of Professor Andrews, I might be considered like the man who held his candle up in the broad blaze of the sun. Very recently, sir, it has been made my duty to investigate the charitable institutions of Maryland, and the evils and wretchedness which I found there have been embodied in a report to the government of Maryland, and will, I trust, have the most beneficial effect. I am satisfied that many of these evils could be remedied if greater attention were paid to the very points to which Professor Andrews has alluded. Indeed, we all know that crime is poverty, as has been demonstrated by the work of Diredale, of New York. My inspection of these institutions went very far to confirm the report of R. L. Dugdale, Esq., to which Dr. Harris supplied most excellent prefatory notes. How the poor shall be best enabled to meet the contingencies of sickness, is a question the importance of which cannot be too highly estimated; and we should be willing to adopt any plan, — and the suggestions especially of Professor Andrews, — but any plan which will enable them to escape these great evils. I am satisfied, sir, that by proper attention to this class of people poverty could be greatly diminished. My observation has been that the first application of the honest, industrious, poor man is occasioned by sickness in his family. And when once this application has been made, the shame of applying for alms has disappeared, and the pride of independence is broken. It therefore behooves us, as benevolent, charitable people, outside of our great desire to improve the sanitary condition of our respective communities, to provide for these people the most efficient medical aid during illness, that the period of illness may be diminished, that their families may be restored to health, and that they may then be returned or restored to their work without being oppressed by debt and degraded by pauperism. It is the first application, sir, that they are forced to make for help that destroys their self-respect, and reduces them to the condition of pauperism. Now, if we could avoid that by any possible means, by supplying proper and efficient medical aid, we should accomplish a great deal. If we could provide them with proper medical aid as well as surgical, it would be a great desideratum. And I believe, if properly organized dispensatories were organized in cities and villages, it would go far towards accomplishing this most desirable object. Of course. how these dispensatories should be organized is a question to be considered, But there is no doubt that they may be organized without the parties who apply to them incurring any reflection upon them as paupers, or their feeling any degradation from their application for aid. There may be several difficulties. We may have a class of individuals who are not able to pay physicians' fees and for medicines. There might be simply a stipend required from them, say five or ten cents a week, which should secure to them the courteous attention of the best medical talent. Physicians who have sufficient charity and humanity give their services time after time in this way, and the poor always secure the proper medicines upon a prescription of a physician. The scheme I propose is not one to which I wish only to make this brief reference. So far as the treatment of the poor in the city I have the honor to represent is concerned, outside of the cities of Maryland, it amounts to absolutely nothing; and this is especially the case with reference to the insane poor. Why, sir, the wretchedness of the places that I have visited is scarcely to be conceived; but it is owing entirely to the fact that the people generally are not aware of the existence of such a state of things.

Of course, in making the report upon this subject, I expected to be severely criticised, and I was most unmercifully dealt with, especially by those whose duty it was to see that these people were better taken care of. However, I do not know that this is to be deprecated, because the blood of the martyr is the seed of the church, and I may as well be a martyr as anybody else. These persons were especially indignant that I should report their institutions out of condition. That was not at all surprising, because very few of us have the grace to unite in the prayer of Burns: —

> "O wad some power the giftie gie us,
> To see oursels as others see us."

But, Mr. President, it strikes me that this Association could accomplish great good by recommending to the States that have not already taken action, attention to this matter, to have their institutions thoroughly investigated. I make no doubt, sir, that there are many States whose institutions are equally bad as those of the State of Maryland. I do not think, sir, that we are altogether behind the rest of the world in humanity or benevolent acts. But this condition of affairs was not known to the people of the State; and as soon as it was brought to their attention a complete revolution began, and has already taken place in reference to the matter; and now, sir, it has been said, that the paupers in the almshouse think the millenium has come. I think, therefore, sir, if this Association would take some action, and express that action to the world, in favor of the investigation of these places, it would have a most desirable effect, and go far towards ameliorating the condition of these people, and do a valuable sanitary work. There can be no question that institutions reeking with filth, as most of these were, give rise to diseases such as diphtheria and scarlatina and other blood poisons; and it seems to me important that we should, as far as possible, recommend to the different communities what, in our judgment, is best in relation to this matter.

Dr. E. Harris, of New York, remarked, that there are "links in the chain of family misfortune and pauperism" that should be broken by sanitary and medical means. The timely surgical and sanitary care which will prevent crippling disability has an important relation to the prevention of pauperism of individuals and families; for this curable disability, if neglected, tends at once, and in the successive generations of a family, to become the cause of dependence, and ultimately of spiritlessness and pauperism. The poor man's dwelling, the sanitary welfare of families, and the prompt and most skillful surgical care of a poor laboring man who needs it, and of the deformed or partly crippled child, have important relations to the prevention of pauperism and all the vices and evils which the term pauperism implies. The *process* and the *proofs* of the social, the physical, and the moral degeneration witnessed in the paupers and vagabonds in any country are easily recognizable; but the first point of departure, whether it be moral or bodily, voluntary or vicious, or involuntary and unexpected or pitiable, may be unheeded by the community and by friends. The stalwart man who sauntered in idleness for fourteen years in one of the New York County poor-houses simply because he was suffering from an uncured inguinal hernia, though curable, became a spiritless pauper. The ignorant family in which is a club-foot, or still worse, a stiff knee, an untreated fracture at the elbow, or a child with hip-disease; or the neglected attendance by surgeon and physician in the poor man's dwelling, when limb, life, health, and the full restoration of bodily powers could be secured at public cost, or by philanthropic aid, have been the occasion of the long future of a career of dependence.

The prompt and effectual care of the injured or sick whose homes are on the verge of want, is a duty that cannot be neglected without social and public harm. The promptings of humanity here lead to the best results, and such duty can never be neglected by the poor-law officials without public harm. There are practical difficulties in drawing the lines on which *absolute rules* shall determine to what persons, what families, and in what places medical and surgical attendance shall be offered gratuitously, or by the superintendents of the poor. Massachusetts has given a fair example of a safe method for giving medical and surgical relief to the destitute without pauperizing the beneficiaries. As physicians and public health officers, we know that wherever sanitation, or surgery, or the best medical care interpose to save life and health, or to compel a deferential regard for such benefactions, the tendency to dependence and pauperism is diminished. Bodily vigor and self-reliance are essential safeguards against spiritless dependence. Sanitary government and medical charities must be so administered as to secure the former and prevent the latter.

Every health officer is justified in accepting the views expressed by Dr. Chancellor, and Professor Andrews, who speaks from the stand-point of Chicago. Dr. Chancellor is somewhat familiar with the public duty of fearlessly looking at the suffering poor of his own State. Though Maryland is a rich and generous State, he has found a condition of things in the almshouses which aroused his indignation. His official report is an exposure of evils. Dr. Chancellor, in looking at the almshouses in Maryland, did what has been done in some of the Western States, as in Wisconsin and Michigan. He saw what he has recited in his report. We have never, in this Association, in the five years we have been at work, said much upon this subject excepting with reference to certain sources of entailed misfortune, and I venture to offer a brief resolution as expressing the thought brought before us this evening.

Dr. HARRIS, the Secretary, offered the following: —

Whereas, Public attention is being urgently invited to the duty of adopting measures for repressing and preventing pauperism; and

Whereas, There are causes of bodily disabilities which induce dependence and the entailment of pauperism, which result from the neglect and incompetence of the attendance and medical sanitary care received by the needy poor when such care should be given;

Resolved, That in the judgment of this Association, it is eminently desirable that there be official inspection and inquiry for ascertaining and repressing the causes of bodily disabilities and pauperism; that this is an important public service in the interests of hygiene and the public welfare; and that those interested require that this duty should be conducted with faithfulness, and the results be published widely for the information of the public.

The resolution was adopted.

DR. CHAMBERS, of the Illinois State Board of Health. — In my portion of the State of Illinois, the centre, all the counties in that region of country employ doctors to attend all the poor at the cheapest possible rate. That is habitual in all the country. They employ them by townships and by counties. They give the care of the poor-house to the man who takes the paupers at the lowest price, and compel him to employ a doctor. Really, this seems to me a proposition in good time, and should receive the attention of everybody. Of course, the Board of Health of Illinois will do what they can in the matter.

THURSDAY MORNING, SEPTEMBER 27.

[F.] *Rendering Tanks, and the Sanitary Treatment of Offal.*

DR. DE WOLF, the Health Commissioner of Chicago, described the "rendering tanks" and fertilizing factories of the city and vicinity, after inspection of the stock-yards and abattoirs. Dr. De Wolf stated that, —

An ox yields from fifty to sixty pounds of offal; swine, from twenty to thirty pounds each. Last year there were slaughtered, in this city and within one mile of its limits, 300,000 beeves and 3,200,000 swine. The offal from all these animals was run through the "rendering" tanks, and manufactured into fertilizers in this city and neighborhood.

Let me give, briefly, a little description of the process: The intestines, with what may adhere to them, the odds and ends of the animal, the decayed fish of the streets and markets, the bones and pieces of beef from the butchers' and slaughter-houses, are placed in tanks, where they are subjected to a steam-pressure of forty to sixty pounds per square inch. This process of steaming is for the purpose of melting the fat, of separating the soft parts from the hard, and for the purpose of breaking up the bone. The process lasts from five to six hours. Under the influence of this pressure, any animal matter, no matter how fresh, would develop offensive gases. This material decomposes with great rapidity, and, if not rendered within twelve or fifteen hours after the animal is killed, the stench from these gas tanks is unendurable. Formerly these gases were passed into the open air, with no attempt to correct them. About five years ago a beef packer in this city invented an apparatus (known as Turner's apparatus) for the consumption of these gases. Subsequently a modification was suggested, which is also patented. This apparatus consumes the offensive gases generated in the rendering tanks. These tanks are made of boiler iron, and hermetically sealed. From this tank runs a tube; and the gas, therefore, must pass into the conductor mingled with the water vapor. This conductor passes into another tank called the condenser. This is supplied with a stream of cold water entering from the bottom. The gases and the watery vapor are conducted to the bottom of this condenser, and as they escape (passing up through this body of cold water) the steam is condensed. The gas rises into the chamber in the tank, above the water line. From this chamber the gases are conducted by another pipe into a tank known as the carbonizer. This tank is partially filled with one of the lighter distillates of coal tar. The gases are passed to the bottom of this tank, and as they escape, and pass through the gasoline, become charged with it, and the chamber above the gasoline is filled with these offensive gases charged with gasoline. The gases are then conducted over the premises, to be burned for illuminating purposes, or conducted under furnaces where the combustion is perfect. By this process there is no offensive odor and no occasion for offensive odors from rendering tanks in this or any other city.

Now we come to another process in the production of these offensive gases. This tankage material, which is drawn from the bottom of the tanks after the cooking of several hours, is passed into wooden vats. The fat is removed, the water drawn off, and the remaining material is called "tankage." This tankage is then put through the "fertilizing process," which consists simply in driving off from forty to sixty per cent. of water from the material. In this process of heating there is a terrible offense created. The volume of gas is very large and very offensive. Until recently there has been no means of entirely correcting the offense from these fertilizing dryers. The mass is of such volume that it cannot be passed through gasoline. One fertilizing establishment where decomposing material is dried is more offensive than half a dozen rendering tanks. There are in this city two hundred and forty-two of these rendering tanks, with a capacity of nine and one half tons for each tank, and forty-nine drying cylinders.

Here is a little plate (exhibiting a diagram) which will answer for the exhibition of a fertilizing establishment. The fertilizers or dryers are simply iron cylinders, twenty or thirty feet in length, and two and one half to three feet in diameter, and armed within with projecting hooks which tear up and comminute the material. These cylinders slowly revolve, with fire underneath. The tankage is put into one end, and as it revolves it works its way towards the other, and when it escapes is dry. The gases have been variously managed during the history of fertilization in this city. In the first place, it was claimed that the offensive element in these gases might be washed with water. An apparatus was constructed known as the "condenser." This will answer (illustrating). Here is an iron tank. The gases are brought in from this cylinder with tremendous velocity, where they meet with the spray of water from above dashing upon them. The gases not removed by washing were conducted into the open air, and it was claimed that they were not offensive; but there was a failure in the plan. A proportion of ammonia can be washed out by the spray, and certain portions cf sulphur compounds may be washed out, as sulphuretted hydrogen. But you will find, after you remove all these, a fetid product remaining. Can that fetid product be burned? No. It has been so claimed, but I believe it is absolutely impossible. The greatest degree of heat producible by coal in an ordinary furnace is less than one thousand degrees. If you burn coke, you may generate a heat of fifteen hundred degrees. That, I claim, would not consume it. I have, in this apparatus, with a small amount of tankage driven off these gases, collected them, and experimented with them. Wash them as much as you please, you wash out the ammonia; wash them again, and you wash out the sulphuretted hydrogen; but there still remains fetid matter. I have subjected this material to twenty-seven hundred degrees of heat, and it still remains fetid. These gases, therefore, cannot be removed by washing, cannot be destroyed by combustion. I learned, in playing with this little affair of a cylinder, that as soon as these fetid gases were submitted to the action of *pernitrate* of iron they were permanently decomposed and destroyed. The problem, then, is this: Can this immense volume of gases be submitted, in any way, to pernitrate of iron in a practical manner? After correspondence with many scientific gentlemen in the country, and aided largely by a gentleman in this city of great ingenuity and large scientific attainment, Mr. Hirsch, a box has been constructed, which has now been in operation fifteen days. The dimensions of the box are not properly exhibited here (showing a model). Here is a black box twenty by sixty by ten feet. This is divided by a number of partitions, which alternately reach within four inches of the end of the box. This box is filled with tin scraps, which is simply sheet iron covered with tin, and which can be had for the drawing. About eighteen to twenty-five pounds of nitrate of potassa are placed in each shelf with the tin scraps, and a few bushels of charcoal. Here (showing) is the drying cylinder, here the conductor bringing the gases in. Before the conductor reaches the box, it is pierced by another conductor from a little sheet iron furnace in which brimstone is burned. We have learned that forty pounds of brimstone burned here every twenty-four hours entirely destroys the odor escaping here. What has happened? The sulphurous acid has become sulphuric acid by an equivalent of oxygen, which breaks up the nitrate of potassa, setting free nitric acid fumes, which attack the iron, and each surface of iron scrap is covered with pernitrate of iron. The gases, in passing through this box, traverse two thousand feet of partition, in addition to the immensely multiplied surface of each little scrap, and escape from the other end without odor, save a little smell of sulphurous acid, which in that neighborhood is beneficial. If the atmosphere were charged with it, it would be of service.

But, in this business, everything is brought to a financial basis. What about the finances of this thing? Manufacturers of fertilizers are compelled to use large quantities of sulphuric acid. Every peck of fertilizer is valuable in proportion to the quantity of ammonia which it contains, and that is fixed with sulphuric acid. Each fertilizing establishment uses say one hundred and fifty pounds of sulphuric acid per day. Now, from sixteen pounds of sulphur fifty-six pounds of sulphuric acid can be generated. After doing its work in this box (and I should have said that the box is on an incline of two inches, being lower at one end than the other), the sulphuric acid drips down the partitions and through the iron scraps, and is collected in this leaden basin at the bottom of one end of the box. The price of sulphuric acid in this market is $2.75 per cwt. Brimstone costs about the same. Mr. Oberndorf, at whose house the box was constructed, used forty pounds a day. He calculates that the excess of sulphuric acid should pay him twice over for the brimstone burnt. This acid is not full strength; but it answers its purpose in the manufacture of fertilizers. I do not want to claim too much, gentlemen, for this box, because a twenty days' experiment will hardly suffice as a sufficient test. What does it cost? It can be constructed for $150, and filled. Of nitrate of potassa $16 worth fills the box, and the box need not be filled oftener than once in three months, running night and day. When necessary to fill it, draw out what remains and stuff in fresh material between the partitions.

Up to this moment I claim that this is the best solution given to the destruction of these gases from the fertilizers, with one exception,—hydraulic pressure. If the proprietors of the fertilizing establishments could be induced to do their work by the cold process, and expel from forty to sixty per cent. of the water by the hydraulic press, there would be no offense. One gentleman is putting in such a press; but it is expensive.

A single word more touching this business of fertilizing and rendering in this city. Some feeling — much feeling, I may say — has been excited in the rendering neighborhoods against the present action of the Health Commissioner of this city in regard to his intentions and desires connected with this work. I say now, and I have always said, that I desire in every possible manner to foster and protect, to aid and encourage this great industry of our neighborhood. But I add this, that the citizens of this city have been outraged ten years by that nuisance, and that either the nuisance must be controlled, the stock yards moved, or the city of Chicago must move; one or the other. I desire, in a single word, to show you what we are attempting to do; and if his honor the Mayor [Mayor Heath] were not present, I should say something more of his interest in sanitary matters connected with this city. Mayor Heath, as Mayor of the city and as chairman for long years of the finance committee of the Common Council, is worthy of admiration for the interest he has taken in the matters connected with the sanitary history of this city. Chicago is blessed to-day with a Common Council honest, intelligent, honored, and that cannot be bought with money. On the 27th day of last month, the Council passed the following ordinance, which no other Council of this city ever dared to pass: —

AN ORDINANCE

Regulating the Slaughtering, Packing, Rendering, and Fertilizing Business.

Be it ordained by the City Council of the City of Chicago:

SECTION 1. It shall be unlawful for any person or persons, company or corporation, within the city of Chicago, or within one mile of the limits thereof, to engage in the business of slaughtering animals for food, packing them for market, or rendering the offal, fat, bones, or scraps from such animals, or any dead carcass, or any animal matter whatever, or to engage in the manufacture or production of fertilizers or glue, or the cleaning or rendering of intestines, unless he or they shall have obtained a license for such business. The Mayor is hereby authorized to issue a license for such purpose to any person or persons applying to him in writing for the same. Such application shall specify the place and location, and the character of the business for which license is desired, and the applicant shall pay into the city treasury, as a license fee, the sum of one hundred dollars ($100) per annum.

SECT. 2. Any license so granted may be revoked upon written notice by the Mayor, whenever it shall appear to his satisfaction that the party so licensed shall have violated any provision of any ordinance of the Common Council, or any statute law of the State of Illinois, relating to said business of slaughtering, packing, rendering, and manufacturing of fertilizers or glue.

SECT. 3. The Commissioner of Health, or any or all of his sanitary officers, shall be permitted free entrance at all hours of the day or night, to all buildings used for the purpose specified in section 1 of this ordinance, and to free and unrestrained examination of all apparatus or utensils used in such manufacture, or in the disposition of gases generated in such manufacture.

SECT. 4. Any person who shall violate any provision of any section of this ordinance shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined in a sum not less than twenty-five ($25) dollars nor more than one hundred ($100) dollars, and one hundred ($100) dollars a day for each and every day he shall continue to carry on said business without a license; and upon a second, or any subsequent conviction, for the like offense, he shall, in addition to the same fine imposed for the first offense, be imprisoned in the house of correction for a period of not less than thirty (30) days nor more than ninety (90) days, and the Mayor shall revoke his or their license immediately on being notified of such conviction.

SECT. 5. This ordinance shall take effect immediately after its passage.

How will this ordinance work? It became a law twenty days ago. Every manufacturer of this product, every slaughtering house within the limits of the city of Chicago, to-day has his license. The Packing Association of the stock yards have until next Monday morning to say whether they will take a license or not. They claim they are within the town of Lake, and that the ordinance is not operative upon them. Every man running a fertilizing establishment within one mile of this city, and who refuses to take a license, shall be sued from that day until the end of my term of office. This interest is great and powerful; it represents $22,000,000. But I claim that if they represent $22,000,000 I represent $200,000,000. I hope those gentlemen will be reasonable enough to take out their licenses, and in good faith put in the simple apparatus I request, or some other, and to do what they can to relieve us from the insufferable nuisance to which the citizens of Chicago are subjected. Their chimneys carry gases two hundred feet high, and the prevailing southwest winds bring them right upon us, and as they cool and settle down, not a window can be opened in some parts of the city after nine o'clock at night.

May I venture to ask for five minutes more, and call your attention to a fact which perhaps you have witnessed this morning. Some of you have been to the stock yards. I want to give you a statement connected with a branch of the river at this stock yard neighborhood. Here is the line of the lake (a chart being shown), and the east front of the city. Here is the Chicago River, and it cannot run into the lake, because man has deepened its channel and caused it to flow in the opposite direction into the Mississippi. The river divides here into two branches, one called the South Branch, and the other the North Branch. This branch (the South Branch) passes through the city, and reaches Thirty-ninth Street, where it forks. Here are the city limits at Thirty-ninth Street. These little forks were originally small streams, but the proprietors of the stock yards have dredged them out until they are of the dimensions of the river in the city. Now, coming into the Fork there are four drains. One drains the stock yards proper; another drains fifteen packing-houses; another drains six. These packing-houses have been depositing in that part of our river thirty cubic yards of solid animal matter a day when they are running, and you will remember that at this point the river is as dead as the Dead Sea. Last May I insisted that these packers should do something to relieve us from this nuisance. They had been permitted to drain here for eight years without complaint. I required that they should connect these drains with one main drain, and on the line of that drain place four catch basins, each forty feet long. They are now taking from these catch basins twenty tons of animal matter a day, which is valuable as a fertilizer, that formerly ran into the creek, while the water holds a large amount of animal matter in solution which the catch basins cannot remove. His honor the Mayor, eighteen months ago, suggested, and it has been approved by the City Engineer, that a canal should be dug from some point of this Fork to the Illinois and Michigan Canal, so that the contents should pass into the canal. By this arrangement we can keep this water constantly changed. A mile in extent has been surveyed and mapped out, and will be completed very soon, I hope. That there exists here a great and dangerous offense, is true.

There are other matters connected with our city of great interest to you as sanitarians, which ought to be reviewed. Our epidemics of scarlet fever should be considered. Yesterday, I was prepared to present to you the statistics of scarlet fever, as it has appeared in this city, but the paper read was of such a character that the dignity of the Society would not permit its discussion. Therefore we dropped it. I desire to say this thing for the profession of Chicago, that in my efforts, since the first day of February, to collect the statistics of this epidemic, and to quarantine, so far as it lies within the power of man to quarantine this terrible epidemic that has plagued us for twenty-two months, I have been supported loyally, honestly, and honorably by the medical profession of this city, with three or four exceptions. [Applause.] They have sustained the hands of the Health Commissioner, aided him in every way by their encouragement and reports. [Applause.]

Dr. Folsom. — I have not been expecting to speak upon this subject. It is one to which our Board (Massachusetts) has given a great deal of attention. A number of gentlemen have been out this morning to visit the ground of the stock yard and slaughter-houses, and I think I state a fact when I state that they are in an inexcusably filthy and stinking condition. It is perfectly proper that a fair profit should be made, but it would be better to have cleaner premises, and make not quite so much profit. It adds but a small percentage of profit to make a bad smell and to disturb a community. I think I should risk my reputation that the city of Chicago will suffer from a recurrence of pestilential disease until the air is made reasonably pure. The processes which have been described for this object are very interesting indeed. There are three that seem to be important: First, to get rid of the offensive gases; second, to get rid of the tankings; and third, to get rid of the soup, or liquor. So far as the first process is concerned, it seems to me it will be efficiently provided when fresh material is rendered in the tanks. In the summer time, this offal becomes offensive within six hours. Of course, in the winter weather it is longer. After it becomes putrid, I do not believe there is any process by which it can be rendered so that the gases may be allowed to pass out of even a high chimney unless some strong mineral acid is used beforehand, and, of course, that injures the tanks. It seems to me that it should be insisted upon that the offal rendered is fresh. That is not difficult where the rendering establishments are so near the slaughtering houses. Then there are a number of questions to be considered. In the first place, the gases are separated from water and passed under the furnace fires, and the proper way is to pass them under the fires when the cooking is not going on. I do not see any other way of getting rid of the difficulty than having them connected with several boilers, and then pass the gases under that one in which there is a fire of intense heat. I do not think we can get heat enough to destroy these if the matter is offensive when first used. There are within two miles and a half of the State House of Boston three large establishments in which nearly a million animals are killed, and I think there has been no offensive smell within the last two years. Of course, proprietors object to making proper improvements, — say they cannot do it. Fortunately, the law of Massachusetts gave the Board of Health the power of closing those institutions. The proprietors had no alternative but to close them or run them so as to be inoffensive. They chose the latter, and are still carrying on business and making money.

In reference to the tankings, it seems that the same state of things is true. If the matter is originally fresh, I do not think there is so much difficulty in getting rid of the gases. At least we have not found it so at Brighton. If they are entirely fresh, and carried directly from the slaughter-houses to the tanks, a moderate heat will dry the tankings, and, so far as my experience goes, none of those extremely offensive gases are set free. The method at Brighton is to pass them directly on the floor of the second story from the tanks. They dry a little there, by exposure to the air, with an offensive odor which may be noticed two hundred or three hundred feet. I have noticed it six hundred feet, but never outside the grounds of the establishment. Then it is put into the drier, in which a moderate heat is used, and, so far as my experience goes, we have had none of these difficult cases to deal with. The disposition of the soup is as important as any other matter, as it contains an immense amount of organic matter. If you fill a barrel with it and place it in the sun, it will burst in six hours. It is one of the most difficult fluids sanitary officers have to deal with. A great part of it can be utilized. The parts coming from the bones, head, and feet can be made into glue at a fair profit. The parts from the offal are more difficult to deal with, and cannot, at the present time, be utilized in that way. But if it cannot be disposed of in that way it can in another; and I think it should be insisted upon, because it is inexpensive. That is, by mingling it with cheap disinfectants, as chloride of lime, or something else. At all events, it can be disposed of in that way at a fair cost, so that when it passes into the streams it is not in a filthy condition. Of course, disinfectants do not destroy organic matter. They simply arrest decomposition for a certain length of time. Decomposition will go on slowly, but be distributed over a large area of country. I simply wish to say that I think that your health officer is correct in his statements that the basis of the pestilential diseases which you have from time to time here, result largely from the condition of the atmosphere; and until you get rid of that, you will not get rid of pestilences. These nuisances must be put under strict discipline. In Massachusetts, the slaughtering establishments are so completely under the State Board of Health, that no piece of machinery, no wheel of any kind, was put in until it received the approval of the State Board of Health. In that way, it seems to me, injuries likely to arise have been reduced to a minimum. The people of Brighton will testify that they do not notice any offensive smell, although there is some smell of fresh blood in the immediate neighborhood of the slaughtering houses.

DR. DE WOLF. — I would take the gentleman, or any other who chooses to join me, to a tank of the most fetid material you can imagine, and have you witness the destruction of these gases, to test the question whether it is possible to entirely destroy these offensive odors from the rendering tanks by burning them, after the preparation referred to. Dr. Folsom doubts whether it is possible to destroy these gases by combustion after the product is fetid.

Dr. Folsom. — I did not mean to convey that idea. So far as my experience goes of the methods in use, I have no doubt that this process will be successful, because Dr. De Wolf has tried it. I simply meant to say, that of all processes thus far used, I never knew anything that would destroy these gases.

Dr. De Wolf. — The question is so important it will be well for you to see this apparatus. I should be glad to take any of you gentlemen over to see it.

Dr. Gihon. — It has been remarked that epidemic influences proceed from distinct centres. I would like to ask whether these centres have any relation to these slaughtering establishments. Last year Dr. Morris, of Baltimore, traced an outbreak of scarlatina to the contiguity of slaughter-houses. I experienced something of the same sort last winter. Quite an epidemic of scarlet fever visited Annapolis. Among the three thousand or four thousand people, there were six hundred cases of scarlet fever or measles. I observed that most of these cases started from two points on the line of drainage of the slaughter-houses of the city; and in connection with the scarlet fever I might state that I did what, until yesterday, I did not know would meet with the approval of the profession, — established a rigid quarantine at Annapolis. I have some two thousand people for whose health I am responsible; and it occurred to me that the best way to keep the young men at Annapolis under my charge from being affected by the disease, was to establish most rigid quarantines. I did it, and succeeded in keeping out the disease, with two exceptions only; and I isolated them as far as possible, with the result that among the two thousand we only had two solitary cases. Now, I am not prepared to say that the slaughter-houses were the cause of the scarlet fever; but it is a fact that in the vicinity of the slaughtering establishments, and on the line of two streets through which the blood runs into the river, the scarlet fever started and spread.

Dr. Chancellor. — I want to make a statement which is corroborated by others. Our slaughtering establishments in the city of Baltimore are erected in two sections of the city, — in the northwestern and the western. Last year we had much scarlet fever, amounting almost to an epidemic. It was observed that this disease took its origin in those two sections of the city in which the slaughtering houses were located, and spread from those points. After a considerable time the disease was confined to the immediate neighborhood of these slaughter-houses.

Dr. Kearney, of Cincinnati. — In Cincinnati, for the last year or two, we have been exempt from scarlatina, with the exception of an occasional case, — not enough for the basis of any remarks. With regard to taking care of offensive gases of fertilizing establishments, I cannot say much. Our slaughtering establishments in Cincinnati are, of course, not as extensive as in this city; and they are not by any means as offensive, or the cause of such a nuisance to the general public. I do not think there is any satisfactory system for the prevention of offense from escaping gases. There are establishments which are very much complained of because of the offense they create. I do not think any of them have adopted any system such as we have heard described.

DR. DE WOLF reviewed the sanitary statistics of the several wards in Chicago: Take the Thirteenth and Fourth Wards. The Fourth Ward, with thirty thousand people, has one hundred and forty feet of drainage to the acre; while the Fourteenth Ward, with fifty-two thousand people, has thirty feet of sewerage to the acre. In the Fourth Ward we have a mortality of fifteen in a thousand each year, and in the Fourteenth Ward a mortality of forty-two per thousand each year. What influence has the sanitary condition had upon scarlet fever? None whatever. The number of scarlet fever cases has been as great in the Fourth Ward as in the Fourteenth or the Fifth. We have just as many cases, proportionally, in the best as in the worst wards; but the death-rate is materially modified. Thirty-five per cent. in the Fifteenth Ward die, while only fourteen per cent. of the children in the Fourth Ward die; and between these two extremes all the wards may be classed. The death-rate is essentially modified by sanitary conditions, while the number of cases in a ward does not seem to be affected in any way.

DR. H. A. JOHNSON, of Chicago. — I only wish to say this, that the last remark of Dr. De Wolf is in accordance with my own observation, and agrees fully with the conclusions drawn from those observations. The scarlet fever is produced by a specific poison, and not by general causes; and the distribution of the disease is largely independent of local sanitary conditions, — I will not say absolutely, because I think the general vitality, the condition of health, in a community has some influence in giving increased resistance to morbific influences. But, so far as the mortality is concerned, the local sanitary arrangements have great influence. I could point out sections of this city where scarlet fever occurred during the last twenty-two months, in which the local sanitary arrangements are good, but where from some cause the seeds of disease are spread. Where there are no foul odors, the mortality in such districts is likely to be less than in regions where the southwestern winds bring the odoriferous products of Bridgeport into every room. As to the sanitary problems of Chicago, certainly they are full of interest. I think the gentlemen who have visited our river and the slaughtering houses will remember that we are now from five to eight feet above the original level, and that this has been accomplished during the last thirty years. Experiments have been tried, and will have to be tried again; and, if we reach an approximate solution, I think we shall be fortunate. You must remember the location of the slaughtering establishments is unfortunate for the city; but the Health Department is not responsible for that. There are millions of dollars invested in the business absolutely independent of local regulations. All we can do is to enforce such laws as the Legislature has given us, and even in the enforcement of these laws we meet with great difficulties. It is possible to bring thousands of persons to testify that these places are the most salubrious in the city.

They will swear to it, and it is a fact that the people living in these localities do not suffer to the same extent from the surroundings that we would expect. There is a kind of accommodation of the human body to its surroundings, — a kind of adjustment of internal relations to external relations, as Herbert Spencer defines life, which renders them able to resist the causes of disease to some extent.

We have in nine days out of ten the gases of Bridgeport borne over the city by the southwestern winds. They take up these gases readily, hold them in suspension, and take them to the lake shore where the air is cooler, and there precipitate them, so that we have a ready absorption of gases from the southwestern winds, and a precipitation of them by the cooler winds of the lake shore. We are peculiarly unfortunate in our geographical relations to the winds and the lake, in the influence they exert upon us. The possibility of entirely destroying these gases is a scientific problem. I believe it is possible to destroy them; but practically it is very difficult to work up the scientific probabilities of the case. The price of immunity is eternal vigilance, and it is difficult to get that vigilance, from the fact that only a limited number of persons can be interested in it. We are partly to blame ourselves. I do not think the Health Department of the city of Chicago has been as much to blame as the business men of Chicago. It is within the province of any three citizens of Chicago to enforce the laws. They may go and enter complaints, array the parties before the courts, bring their evidence and secure conviction. But conviction is a small matter, with a fine of $25, when the infractor makes much more than $25 by violation of the law. We have great difficulties in the management of this department, — difficulties that perhaps would at least have been lessened had the manufacturing interests been slower in their development. Had our growth, as a city, been less rapid; had our location been upon better soil, and had we a large running stream or a tide wave, the sanitary difficulties would not be so great. From the lack of these we find peculiar local difficulties.

ABSTRACT OF MINUTES OF THE FIFTH ANNUAL MEETING.

CHICAGO, SEPTEMBER 25–27, 1877.

TUESDAY, SEPTEMBER 25.

THE Association convened at three o'clock P. M., in the parlors of the Grand Pacific Hotel, Dr. J. H. Rauch, President, in the chair.

An Address of Welcome was delivered by Mr. Wirt Dexter, of Chicago.

The annual address of the President was delivered by Dr. Rauch, the subject being "The Sanitary Problems of Chicago."

The Secretary read his Annual Report.

Mr. E. S. Chesbrough read a paper on "The Sanitary Drainage and Sewerage of Chicago." The paper was discussed by Dr. C. F. Folsom, of Boston, and others.

Dr. Folsom presented a draft of a proposed law relating to pollution of streams. The subject was discussed by Drs. Harris, Ames, Hitchcock, and others. Dr. Harris offered the following resolution, which was adopted: —

Resolved, That a Committee of five members of this Association be appointed by the President to confer with the author of this paper on 'Pollution of Streams,' and to report on the last day of this meeting the suggestions and action which in their opinion should be recommended by this Association.

The President appointed as such committee, Mr. Chesbrough, Professor Churchill, Dr. Harris, Dr. Kearney, Dr. Reeve.

The Treasurer's report was submitted, and the following committee appointed to audit the same: Dr. Neal, Dr. Baker, and Dr. Hewitt.

The Association then adjourned to meet at eight o'clock P. M.

EVENING SESSION.

The Association met pursuant to adjournment, Prof. N. S. Davis, M. D., in the chair. After a brief address by the presiding officer, a discourse was delivered by Dr. Hosmer A. Johnson, the subject being "The Sanitary Geography of Phthisis Pulmonalis and other Pulmonary Diseases in Chicago and other Cities of the Northwest."

Dr. T. J. Turner, Medical Inspector U. S. N., presented a paper on "Air and Moisture on Shipboard."

Dr. A. L. Gihon, also of the Navy, followed, with further statements confirmatory of the leading conclusions of Dr. Johnson's paper.

Dr. J. M. Gregory, Regent of the Illinois Industrial University, then read an essay on "The Relation of Hygiene to the Higher Education."

On motion of Dr. Harris, the thanks of the Association and of this meeting were voted to the authors of the discourses this evening for their valuable contributions to objects of this Association.

The meeting then adjourned.

WEDNESDAY, SEPTEMBER 26.

The Association convened at eleven o'clock A. M., Dr. Rauch, President, in the chair.

Dr. George L. Andrew, of La Porte, Ind., read a paper on "The Sanitary Value of Forests."

The Secretary presented a contribution from Professor Wm. H. Brewer, of the Agricultural School of Yale College, containing a series of questions based on Dr. Andrew's paper, which was referred to the Executive Committee.

The subject of Dr. Andrew's paper was discussed by Professor Churchill, Dr. Harris, and others.

A paper by Dr. Ezra M. Hunt, of New Jersey, on "Sanitation of Individuals and Families as a Mode of arresting and preventing Pestilential Epidemics," was read by the Secretary.

A report on "The Teachings of Twenty-two Years' Observations and Records of Mortality from Croup, Diphtheria, and Scarlatina," by Dr. Edwin M. Snow, Superintendent of Public Health, Providence, R. I., was read in abstract, and on motion, this paper, and the charts, etc., pertaining to it, were referred to the Publishing Committee.

On motion, the paper of Dr. Ezra M. Hunt was referred in the same manner as that of Dr. Snow.

The Secretary submitted, by permission of the Chair, the outlines of a report and paper on the experience of New Orleans in guarding that port and city from yellow fever, by Dr. Samuel Choppin, President of the Board of Health of Louisiana, and of the Board of Health of New Orleans. On motion this report was accepted and referred to the Publishing Committee.

Dr. Henry M. Lyman, of Chicago, read a paper on "Stamping out Scarlatina and the Extinguishing of Zymotic Diseases," illustrated by charts.

Dr. Folsom made some remarks regarding the above paper, after which the Association adjourned to three o'clock P. M.

AFTERNOON SESSION.

Dr. Azel Ames, Jr., read a paper on "The Removal and Utilization of Domestic Excreta."

Dr. N. S. Davis read a paper on "The Means of Diminishing Infant Mortality from Bowel Affections," which was discussed at some length by Drs. Hamill, Lyman, Cohen, Harris, and Turner.

In the absence of Professor Hitchcock, of Amherst College, Mr. Woodbridge read the paper furnished by Professor Hitchcock, on "Hygiene at Amherst College," which was followed by an essay on "Female Physical Culture at Ann Arbor College, Michigan," by Dr. L. H. Cohen, of Quincy, Ill. The Association then adjourned till eight o'clock.

EVENING SESSION.

The Association assembled at eight o'clock, Dr. E. Ingalls in the chair.

Dr. Edmund Andrews read a paper on "The Sanitary and Economical

Importance of the best Surgical and Medical Treatment of the Needy Poor." The paper was discussed by Dr. Chancellor, of Baltimore; after which Dr. Harris offered the following resolution in reference to the subject: —

Whereas, Public attention is being urgently invited to the duty of adopting measures for repressing and preventing pauperism; and,

Whereas, There are causes of bodily disability which induce dependence and entail pauperism, which result from the neglect or incompetence of the attendance and medical and sanitary care received by the needy poor when such care should be given:

Resolved, That, in the judgment of this Association, it is eminently desirable that there be official inspection and inquiry for ascertaining and repressing the causes of bodily disability and pauperism; that this is an important public service in the interests of hygiene and the public welfare; and that those interests require that this duty should be conducted with faithfulness, and the results be published widely for the benefit of the people.

The resolution was adopted.

Dr. Lyman read a paper on "The Present State of the Exact Knowledge of the Causation and Prevention of Epidemic Diseases."

Rev. Brooke Herford read a paper on "Public Holidays and Public Health." The Association then adjourned.

THURSDAY, SEPTEMBER 27.

The Association was called to order by the President at ten o'clock. Mayor Heath entered, and was invited to a seat on the platform.

Dr. De Wolf, Health Commissioner, read a paper on "The Destruction of Offensive Gases from Rendering Tanks and Fertilizing Establishments." The subject was discussed at length by Dr. Folsom of Boston, Dr. Chancellor of Baltimore, Dr. Gihon of the Navy, Dr. Kearney of Cincinnati, and Dr. Johnson of Chicago.

The Auditing Committee reported that the Secretary's account and the Treasurer's report were found correct. The Committee's report was received and adopted.

The following officers were then elected for the ensuing year: President, Dr. Elisha Harris, of New York; First Vice-president, Dr. J. L. Cabell, of Virginia; Second Vice-president, Dr. Hosmer A. Johnson, of Illinois; Secretary, Dr. E. H. Janes, of New York; Treasurer, Dr. Charles F. Folsom, of Massachusetts. Executive Committee, Dr. John H. Rauch, President State Board of Health of Illinois; Dr. C. B. White, ex-President State Board of Health, Louisiana; Dr. C. W. Chancellor, Secretary State Board of Health, Maryland; Dr. John T. Reeve, Secretary State Board of Health, Wisconsin; Dr. C. N. Hewitt, Secretary State Board of Health, Minnesota; Dr. Thomas J. Turner, Medical Inspector U. S. N.

The Association then adjourned.

AFTERNOON SESSION.

Dr. Harris read "A Report on a Practical Method for securing Complete and Authentic Records of the Causes of Death throughout the United States." This paper was ordered to be published and submitted to the several State Boards of Health, with a view to their action on the subjects discussed.

The Secretary submitted special communications relating to the census, from Dr. J. S. Billings and Gen. F. A. Walker, which were referred to the Publishing Committee with power.

The following papers were then read by title: "Water Supplies in Country Districts, Villages, and Large Towns, especially considering the subject of Filtration," by Dr. Thad. Stevens, of Indianapolis. "Ozone and Heat," by Dr. L. H. Cohen, Quincy, Ill. "Sanitary History of the Establishment of a City," by Dr. A. N. Bell, of Brooklyn, N. Y. "Safety in Railway Traveling," by Dr. Dunot, of Harrisburg, Penn. These papers were referred to the Publishing Committee with power.

Dr. C. N. Hewitt read a paper on "The Work of Hygiene in the Education of the Children in the Common Schools, and in the Families and Society in which they live." Referred to the Publishing Committee.

The thanks of the Association were voted to the German National Board of Health for courteous interchanges.

On motion of Dr. Chancellor, the thanks of the Association were voted to the citizens of Chicago and to members of the press for their extended courtesy.

Dr. Folsom's resignation as Treasurer was read and accepted, and Dr Henry B. Baker, of Michigan, was elected to fill the vacancy.

The subject of the time and place for the next meeting was referred to the Executive Committee with power.

The Association then adjourned.

LIST OF MEMBERS ELECTED AT THE FIFTH ANNUAL MEETING.

DR. PHILIP ADOLPHUS, Chicago, Ill.
DR. GEO. L. ANDREW, La Porte, Ind.
DR. LUTHER C. BEAN, Chicago, Ill.
GEN. JAMES BINTLIFF, Member State Board of Health, Janesville, Wis.
DR. H. VAN BUREN, Chicago, Ill.
DR. NORMAN BRIDGE, Chicago, Ill.
DR. R. G. BOGUE, Chicago, Ill.
DR. D. R. BROWER, Chicago, Ill.
DR. W. H. BYFORD, Chicago, Ill.
N. BATEMAN, LL. D., President Knox College, Galesburg, Ill.
HON. HENBY BOOTH, Chicago, Ill.
DR. J. E. BODINE, Trenton, N. J.
PROF. CYRUS F. BRACKETT, Princeton, N. J.
DR. ANSON L. CLARK, Member State Board of Health, Elgin, Ill.
REV. ROBERT COLLYER, Chicago, Ill.
PROF. H. B. CORNWALL, Princeton, N. J.
DR. W. M. CHAMBERS, Member State Board of Health, Charleston, Ill.
DR. JAMES CRANE, President Board of Health, Brooklyn, N. Y.
DR. L. H. COHEN, Quincy, Ill.
DR. LESTER CURTIS, Chicago, Ill.
DR. LUCIUS D. CLARK, Rockford, Ill.
DR. D. L. CLARK, Rockford, Ill.
J. JAMES R. CROES, Civil Eng'r Dep't Public Parks, New York, Yonkers, N. Y.
PROF. GEO. CHURCHILL, C. E., Knox College, Galesburg, Ill.
DR. FRANK DAVIS (reëlected), Chicago, Ill.
DR. J. B. DAVISON, Moline, Ill.
DR. M. M. DAVIS, Baraboo, Wis.
DR. LOBER DENNIS, Member State Board of Health, Newark, N. J.
DR. F. A. EMMONS, Chicago, Ill
DR. J. H. ETHERIDGE, Chicago, Ill.
HON. L. C. P. FREER, Chicago, Ill.
DR. T. D. FITCH, Chicago, Ill.
DR. A. H. FOSTER, Chicago, Ill.
DR. GEO W. FOOTE, Galesburg, Ill.

DR. MOSES GUNN, Chicago, Ill.
J. H. GREGORY, LL. D., President Industrial University, Champaign, Ill.
REV. MUNROE GIBSON, Chicago, Ill.
DR. E. W. GRAY, Secretary State Board of Health, Bloomington, Ill.
DR. W. S. HAINES, Chicago, Ill.
DR. W. S. HARROUN, Chicago, Ill.
DR. M. O. HEYDOCK, Chicago, Ill.
PROF. EDWARD HITCHCOCK, Amherst, Mass.
DR. JOSEPH HOBBINS, Madison, Wis.
DR. J. H. HOLLISTER, Chicago, Ill.
DR. HENRY HOOPER, Chicago, Ill.
DR. F. C. HOLZ, Chicago, Ill.
HON. MONROE HEATH (Mayor), Chicago, Ill.
REV. BROOKE HERFORD, Chicago, Ill.
DR. J. W. HUTCHINS, Chicago, Ill.
DR. JAMES N. HYDE, Chicago, Ill.
GEO. A. INGALS, Chicago, Ill.
DR. E. F. INGALS, Chicago, Ill.
DR. E. INGALS, Chicago, Ill.
DR. R. N. ISHAM, Chicago, Ill.
DR. SAMUEL J. JONES, Chicago, Ill.
HON. JOHN A. JAMESON, Chicago, Ill.
DR. A. R. JACKSON, Chicago, Ill.
DR. S. D. JACOBSON, Chicago, Ill.
DR. H. W. JONES, Chicago, Ill.
DR. WALTER KEMPSTER, Sup't Northern Asylum for Insane, Winnebago, Wis.
DR. THOMAS H. KEARNEY, Health Officer of Cincinnati, Ohio.
DR. J. S. KNOX, Ass't Health Commissioner, Chicago, Ill.
MOSES LANE, C. E., City Engineer, Milwaukee, Wis.
PROF. A. R. LEEDS, Stevens Institute, Hoboken, N. J.
DR. J. BERRIAN LINDSLEY, Secretary State Board of Health, Nashville, Tenn.
DR. C. A. LOGAN, Chicago, Ill.
DR. R. LUDLUM, Member State Board of Health, Chicago, Ill.
DR. W. J. MAYNARD, Chicago, Ill.
DR. P. H. MATTHEI, Chicago, Ill.
DR. H. P. MERRIMAN, Quincy, Ill.
DR. DE LASKIE MILLER, Chicago, Ill.
HON. S. M. MOORE, Chicago, Ill.
DR. W. T. MONTGOMERY, Chicago, Ill.
ROBERT MOORE, C. E., Commissioner of Sewers, St. Louis, Mo.
DR. TRUMAN W. MILLER, U. S. Marine Hospital, Chicago, Ill.
DR. D. T. NELSON, Chicago, Ill.
EZRA A. OSBORN, C. E., Member State Board of Health, Middletown, N. J.
DR. J. E. OWENS, Chicago, Ill.
DR. G. C. PAOLI, Chicago, Ill.
DR. HENRY PALMER, Janesville, Wis.
DR. R. U. PIPER, Chicago, Ill.
DR. WILLIAM E. QUINE, Chicago, Ill.
DR. J. M. RIDGE, Member State Board of Health, Camden, N. J.
DR. E. O. F. ROLER, Chicago, Ill.
DR. JOSEPH P. ROSS, Chicago, Ill.
HON. JOHN C. ROGERS, Chicago, Ill.
T. D. ROBERTSON, Rockford, Ill.
DR. E. W. SAWYER, Chicago, Ill.
DR. C. P. SIMON, Chicago, Ill.
DR. C. G. SMITH, Chicago, Ill.
C. W. SOULE, C. E., Chicago, Ill.
DR. D. A. K. STEELE, Chicago, Ill.
DR. S. H. STEVENSON, Chicago, Ill.
DR. C. B. STEMEN, Van Wert, Ohio.
DR. ISAAC H. STEARNS, Health Officer, Milwaukee, Wis.
LEANDER STONE, Chicago, Ill.
REV. DAVID SWING, Chicago, Ill.
DR. THOMAS J. TURNER, Med. Inspector U. S. Navy, Washington, D. C.
CHAS. H. THOMSON, New Haven, Ct.
DR. T. R. VARRICK, Member State Board of Health, Jersey City, N. J.
DR. EDWARD P. VOLLUM, Surg. U. S. Army, St. Louis, Mo.
DR. JOHN A. WARDER, Cincinnati, Ohio.
DR. F. L. WADSWORTH, Chicago, Ill.
ASHBEL WELCH, C. E., Lambertville, N. J.
DR. S. WICKERSHAM, Chicago, Ill.
DR. HORACE WARDNER, Cairo, Ill.
DR. JOHN F. WILLIAMS, Chicago, Ill.
DR. C. N. WITTER, Grand Rapids, Wis.
DR. OSCAR C. DE WOLFE, Health Commissioner, Chicago, Ill.
JOHN WOODBRIDGE, Chicago, Ill.
HON. E. S. WILLIAMS, Chicago, Ill.

ABSTRACT OF DISCUSSIONS AND MINUTES OF THE SIXTH ANNUAL MEETING.

RICHMOND, VA., NOVEMBER 19–22, 1878.

TUESDAY, NOVEMBER 19.

THE Association convened at half past seven P. M., at Mozart Hall, called to order by the President, Dr. Elisha Harris, of New York. Prayer was offered by Rev. Dr. Peterkin, of Richmond. Dr. S. P. Moore, of Richmond, introduced His Excellency, F. W. M. Holliday, Governor of Virginia, who delivered an Address of Welcome. During the remainder of the evening Governor Holliday occupied the chair.

Prof. J. L. Cabell, M. D., first Vice-president, made a brief address, introducing the President, Dr. Harris, who followed with the Annual Address.

Dr. John M. Woodworth, chief of the Marine Hospital Service, made a brief introductory statement relative to the work of the Yellow Fever Commission in the Mississippi Valley.

Hon. Lewis H. Steiner, M. D., of Maryland, followed with an address on the objects of the American Public Health Association.

Adjourned to meet on Wednesday, at ten A. M.

WEDNESDAY, NOVEMBER 20.

The meeting was called to order at ten o'clock by President Harris.

Prayer was offered by Rev. Dr. Read, of Richmond.

The Secretary then read the following letter from the Governor of Tennessee.

EXECUTIVE OFFICE, NASHVILLE, TENN., *November* 14, 1878.

DR. J. D. PLUNKETT, *President State Board of Health.*

Dear Sir: I rejoice to learn that Drs. Atchison, Lindsley, and yourself, with delegations from Memphis, Chattanooga, and other points in the State, will attend the next meeting of the American Public Health Association, and I regret that official business will prevent my own attendance. All I could hope to accomplish, however, by my own presence, would be to testify to the great and growing interest that is felt in the State of Tennessee in the adoption of measures for the prevention of disease, and the protection of the public health. No discussion of the question has occurred in this State until a few months ago, and it is not surprising that we are far behind other States in the promotion of this great reform. I am clear that all that is necessary to secure proper legislation upon this subject is to provide for a general discussion of it, and convince the great body of the people from whose ranks the largest per cent. of victims is furnished to cholera and yellow fever epidemics, that they are the principal beneficiaries of a sound, sanitary policy. When this lesson is learned by the people, a public sentiment will be created and legislation and money will be provided, adequate in character and amount, to secure the coöperation of all the State and full protection to the public health.

Do me the favor to thank President Harris for the cordial invitation extended to myself to be present at the Richmond meeting, and assure him and the members of the Association of my active sympathy with the noble work in which they are engaged.

I will thank you to extend to the Association an invitation to hold the next meeting at Nashville. You are authorized to offer the State capital as the place of meeting, with the assurance of unstinted hospitality on the part of the people of Tennessee. Very truly yours, JAMES D. PORTER.

DR. T. A. ATCHISON, on behalf of the Tennessee delegation, and in the name of the City Council of Nashville, indorsed the invitation extended by Governor Porter.

The following communication upon the same subject was submitted.

RICHMOND, VA., *November* 20, 1878.

GENTLEMEN OF THE EXECUTIVE COMMITTEE: —

The American Public Health Association received this morning an invitation from his Excellency James D. Porter, Governor of Tennessee, to hold its next annual session in Nashville. As a native of the capital city of the State of Tennessee, I would humbly beg leave to add my testimony to the heartiness of the invitation extended, and would ask permission to offer the following of the many reasons that are apparent in behalf of its acceptance: —

Although this meeting is held in a Southern State, it is the first and only time that the South has been thus honored. For five consecutive seasons have the meetings been held in the North. I regard it as asking only a part of our due to expect two consecutive sessions in the South. But enough of this: sanitary science is *not* sectional.

Sincerely hoping that this present session may accomplish much, if not the full tide, of success as regards the powers of sanitation to cope with so formidable an adversary as yellow fever, yet there are other epidemics equally as pestilential that have and will obtrude themselves upon our notice. Even during the past few months slight mutterings, indicating a cloud not of the magnitude of a child's hand, have been heard in the distant East, that may, before another meeting of the Association is held, envelop greater areas of our country in gloom and suffering. Nashville's citizens have once and again writhed in sorrow and anguish in the gloom and inexorable grasp of Asiatic cholera; typhoid and malarial disease, diphtheria, and a host of preventible (?) endemic diseases stalk abroad in our land, in my own native State as elsewhere; and, finally, hygiene is but just awakening an interest in the South. Let us strike while the iron is hot, rouse up an enthusiasm in so grand a cause, and go forward with its banner while we can.

And now, apologizing for intruding upon you, as well as endeavoring to add anything to the cordial welcome extended you by our chief executive through Prof. T. A. Atchison, chairman of the Tennessee delegation, I beg leave to remain, most respectfully, your humble servant,

(Signed) DEERING J. ROBERTS.

By direction of the President, the Secretary then read the following resolutions, which had been passed by the Executive Committee, and which (as was explained by the President) required no action by the Association, the reading of them being simply for information.

Resolved, That all reports, papers, and other documents which are read and received by the Association, shall become the property of the Association, and shall be filed with the Secretary of the Association, for such disposal as the Association or Executive Committee may direct.

Resolved, That, when the yellow fever commission makes its report, the general report of the chairman of the commission shall first be read, and then laid over until the individual reports of the commission, and all papers referring to the subject of yellow fever, are read and received; after which the several reports and papers shall be appropriately referred, without debate.

Resolved, That, after such reports and papers have been acted upon by the committee to whom referred, they shall then be before the Association for discussion.

Resolved, That all papers submitted to the Association, and not hitherto disposed of, shall be submitted to a sub-committee of three, who shall report the disposal to be made of such papers; viz., reading in full, by abstract, by title, or filing.

The committee announced under the last resolution was as follows: Drs. C. B. White, J. L. Cabell, and T. J. Turner.

One hundred and thirty-two gentlemen, whose names had been reported favorably by the Executive Committee, were then elected members of the Association.

Dr. S. M. Bemiss, of New Orleans, Chairman, then read the General Report of the Yellow Fever Commission.

At the conclusion of the General Report Dr. J. A. Cochran, of Mobile, read his report of investigations at Grenada, Miss.

Following the report of Dr. Cochran, Dr. Bemiss read a detailed history of the epidemic at Canton, Miss.

Dr. Lloyd Howard, of Baltimore, then read his report of investigations at Baton Rouge.

Following Dr. Howard's paper, Dr. Bemiss read an account of the yellow fever at Port Gibson.

This was followed by an account of the yellow fever at Brownsville, also read by Dr. Bemiss.

The Association then adjourned.

EVENING SESSION.

The President, Dr. Elisha Harris, in the chair.

The following resolutions, which had been adopted by the Executive Committee, were then read: —

Resolved, That a committee of seven members be appointed by the President, to which shall be referred, without debate, all resolutions, except such as propose national legislation, which committee shall report to the Executive Committee.

Resolved, That the committees on the various papers referred to them be requested to report to the Executive Committee the topics or propositions found suitable for discussion by the Association in General Meeting.

The following resolution, adopted by the Executive Committee, was given to the Press: —

Resolved, That the American Public Health Association, by its Executive Committee, disapproves and disavows the premature publication of the General Report of the Yellow Fever Commission in a New York morning paper.

The following committees were then announced by the President: —

ON THE GENERAL REPORT OF THE YELLOW FEVER COMMISSION: Dr. Jno. S. Billings, U. S. Army; Dr. Jas. Berrien Lindsley, Tenn.; Dr. L. S. Joynes, Va.; Dr. S. O. Van der Poel, N. Y.; Dr. J. G. Thomas, Ga.

ON DR. BEMIS' PAPERS: Dr. R. W. Mitchell, Tenn.; Dr. Geo. W. Sternberger, U. S. Army; Dr. S. Choppin, La.; Dr. C. W. Chancellor, Md.; Dr. R. A. Kinlock, S. C.

ON DR. COCHRAN'S PAPERS: Dr. E. M. Snow, R. I.; Dr. E. L. Griffin, Wis.; Dr. T. A. Atchison, Tenn. (chairman); Dr. J. J. Dement, Ala.; Dr. Jas. A. Steuart, Md.

ON DR. HOWARD'S PAPERS: Dr. Jno. Morris, Md.; Dr. O. S. Iglehart, Ala.; Dr. J. D. Plunkett, Tenn.; Dr. Thos. J. Turner, U. S. N.; Dr. Wirt Johnson, Miss.

ON COL. HARDEE'S REPORT: Col. W. E. Cutshaw, Va.; Dr. J. H. Rauch, Ill.; Dr. W. A. Mussey, Ohio.

ON RESOLUTIONS: Dr. Edwin M. Snow, R. I.; Dr. C. F. Folsom, Mass.; Dr. Stephen Smith, N. Y.; Dr. A. L. Gihon, U. S. N.; Dr. Thos. L. Neal, Ohio; Dr. J. D. Plunkett, Tenn.

ON THE PRESIDENT'S ADDRESS: Dr. Stephen Smith, N. Y.; Dr. E. M. Snow, R. I.; Dr. Ezra M. Hunt, N. J.; Dr. J. A. Steuart, R. I.; Dr. J. H. Rauch, Ill.

Additional names of gentlemen proposed as members were then read by the Secretary and the gentlemen were elected.

The following resolution, offered by Major W. T. Wolthall, of Mobile, was read, and referred to the Committee on Resolutions.

Resolved, That a Committee of   members be appointed to prepare and recommend measures for the more efficient management and control of future epidemics — especially for the training, selection, and employment of skillful and trustworthy nurses.

Dr. Bemiss then read the detailed reports of the investigation concerning the yellow fever at Lake, Miss., at Yazoo City, at Milan, and at Vicksburg.

Dr. Cochran then read an account of the yellow fever at Holly Springs.

On motion, Dr. Sims was allowed to read the report of the yellow fever at Chattanooga, in place of Dr. Cochran, the latter complaining of being exhausted.

The Association then adjourned to meet at ten o'clock, Thursday morning.

THURSDAY, NOVEMBER 21.

Prayer was offered by the Rev. Dr. Jeter, of Richmond.

A number of resolutions were presented, some being read in full, and some by subject only, all of which were referred to the Committee on Resolutions, without debate.

By Rev. Dr. Marshall, of Vicksburg: —

1. *Resolved*, That we respectfully urge upon the General Government of the United States the appointment of a commission of competent citizens, who shall be authorized to visit Havana for the purpose of investigating the rise and progress of the yellow fever; and that they shall be required to investigate what may

be done, if anything, towards the purifying of ships leaving that port during their voyages, and what further may be done in addition to the present methods in use for the further improvement of the practical workings of an improved and general quarantine system.

2. *Resolved*, That the Government be urged to set apart a sum of money sufficient for the full and untrammeled employment of all the time and energies of such commission; and that such commission be composed of physicians, scientists, and laymen, who shall enter upon the work with as little delay as possible.

By Dr. Van der Poel, of New York: —

Resolved, That it be earnestly urged upon the President of the United States to confer with the Spanish Government, and request the appointment of an international commission, who shall study yellow fever at Havana, its principal place of *endemicité*, with a view of adopting measures which shall eradicate its spread in that city.

By Dr. W. H. Beatty, of Mobile: —

Resolved, That a resident physician at each point where yellow fever prevailed be requested by this Association to give such information as he may be able to collect as to the origin and mode of spread of the late visitation, together with the mode of treatment found most successful.

By Dr. R. W. Mitchell, of Memphis: —

Whereas, There has been formed at Washington, under the direction of the Surgeon-general U. S. Army, one of the most valuable medical libraries in the world, and

Whereas, There has been prepared, under the same direction, the manuscript of an Index Catalogue of this library, which, if published, would more than double the practical utility of the collection, and which would be of the greatest value to all medical men and sanitarians, even if the library itself were not in existence; therefore be it

Resolved, That a committee of five be appointed to urge upon Congress the immediate publication of this catalogue, setting forth that such publication, in the opinion of this Association, is one of the most important steps which can be taken by the General Government to promote the interests of sanitary science, and aid investigations into the causes and prevention of diseases.

By Dr. Deering J. Roberts, of Nashville: —

Resolved, That this Association earnestly recommends the establishment of a chair of State Medicine and Public Hygiene in every medical institution of learning in the United States.

By Dr. E. M. Hunt, of New Jersey: —

Resolved, That this Association shall, by a committee, press upon the attention of the Government the need of such methods as shall enable the next census to secure vital statistics on a plan best adapted to aid in the study of questions as to Public Health.

By Dr. Albert L. Gihon, U. S. N.: —

Resolved, That the Executive Committee be directed to provide for the investigation and discussion at the next annual meeting of the most effective means for preventing the spread of venereal diseases.

By Dr. Granville Dowell, of Galveston: —

Resolved, That it is the opinion of this Association that the body does not reproduce the poison of yellow fever, and that without this poison being thrown off from the body of a yellow-fever patient the clothing, bedding, and rooms of such patients would not be infected, and therefore could not infect persons or things; but we recognize from its history and mode of spreading that if this poison is thrown off in an open and pure air the poison will be destroyed, or so diluted that it will not always affect persons in the same room or even sleeping in the same bed.

By Dr. Thomas F. Wood, Wilmington, N. C.: —

Recognizing the necessity of uniformity of action in all States of the Union upon matters concerning the Public Health, and fully appreciating that the machinery necessary to move a whole nation would be cumbersome, and could better be done by the separate action of the States represented in this Association, be it hereby

1. *Resolved*, That we hold it to be very important that Boards of Health be established in each State; that, to be effective, these Boards should be properly empowered to act, and that money should be placed at their disposal to further the steady and vigorous prosecution of the measures which the advance of sanitary art and science may point out as best for the furtherance of the public health.

2. *Resolved*, That a copy of these resolutions be sent to the Executive Department of every State in the Union, with a request that they be brought to the attention of the Legislature.

By Dr. McCaw, of Richmond: —

Whereas, It is confessed by all, that every present known means of disinfection against yellow-fever has proved a failure, and

Whereas, We know that a temperature below the freezing point will kill the germ of the disease, therefore, be it

Resolved, That a committee of   shall be appointed to devise an effective and simple method of producing artificial cold to be applied to the disinfection of clothing, baggage, and other movable property, which may have been exposed to the yellow fever contagion.

Dr. McCaw's resolution was returned from the Committee, indorsed as follows: —

We appreciate the importance of this question, and respectfully recommend that it be referred to the Yellow Fever Commission for their consideration.

For the Committee,

EDWIN M. SNOW, *Chairman*.

By Dr. Atchison, of Nashville: —

Resolved, That Commissioners or others who may be hereafter charged with the investigation of yellow fever be requested to inquire into the local environments which determine the spread of yellow fever when the germ has been introduced.

By Dr. Greenville Dowell: —

Resolved, That we request the President and Congress of the United States to appoint a Commissioner to confer with the authorities of Brazil, and all the South American States that have been afflicted with yellow fever, for the purpose of effecting arrangements with such States that may prevent the spread of yellow fever, and especially its importation into the United States.

The following communication was presented by Dr. Morris, of Baltimore, and referred to the Committee on Papers, without reading: —

"On Saturday, the 9th of November, a committee appointed by the Maryland Academy of Science, and approved by the Academy of Medicine and the Baltimore Medical Association, consisting of Drs. J. R. Uhler, C. C. Bambaugh, and C. L. Oudesluys, waited on President Hayes with the following memorial: —

"TO THE PRESIDENT: The undersigned, a Committee appointed by the Maryland Academy of Science, most respectfully request you to transmit to Congress a message, asking an appropriation and authority to appoint a permanent Scientific and Medical Commission to study and report upon the nature, causes, treatment, and prevention of yellow fever, and allied epidemic diseases; said Commission to consist of twenty or more members chosen from the ablest chemists, physicists, microscopists, biologists, naturalists, and physicians, in the country, with power to select from their own number, and others, workers, in order that the disease may be systematically examined from different points of view, both by acclimated members on the spot and others in the various laboratories of our country.

J. R. UHLER, M. D.
CHARLES L. OUDESLUYS.
REV. JOHN M. HOLMES.
GEORGE W. DAVIDSON.
P. G. SAUERWEIN.
C. C. BAMBAUGH, M. D.

"During the conversation that ensued the following important points were made: —

"1. That the active intervention of men of trained judgment and special qualifications is essential for success.

"2. That the investigation should be commenced at once, before another epidemic occurs, in order that the usual healthy condition of the air, water, food, vegetable and animal life in the infected districts may be accurately ascertained.

"3. That the investigation should be made by a large number of specialists in order that many new methods may be tried.

"4. That a portion of this work can only be conducted in the various large laboratories of the country; hence a number of names of men possessing a national reputation, and connected with Harvard, Yale, the universities of Michigan, New York, Pennsylvania, Maryland, and Louisiana, Bellevue Medical College, Cincinnati Medical School, and the Surgeon-general's office, were suggested for appointment.

"5. The importance of systematic efforts was discussed, and the committee left with the assurance that the memorial would be acted upon, and with the request of the President that it should be widely made known in order that medical and scientific men may induce Congress to pass the bill."

The President of the Association announced an invitation from His Excellency, Governor Holliday, to the gentlemen of the Convention to attend a reception at his residence, in the evening, at any time, according to convenience, between the hours of nine and eleven o'clock.

It was voted that the thanks of the Association be returned to Governor

Holliday, that the invitation be accepted, and that the Governor be at once notified of this action.

The following communication was at once dispatched to the executive mansion.

THE AMERICAN PUBLIC HEALTH ASSOCIATION.

RICHMOND, *November* 21, 1878.

To His Excellency, GOVERNOR HOLLIDAY.

Sir: We have the honor to acknowledge the reception of your cordial invitation to the gentlemen in attendance at the Sanitary Conference of the American Public Health Association, to receive a welcome greeting at your residence this evening.

The Association has passed a vote of thanks, accepting the invitation, and as many as can be absent from the duties of this evening's session of the Conference will enjoy the privilege of your kind reception.

With great respect, etc., ELISHA HARRIS, M. D., President.

E. H. JANES, M. D., Secretary.

It was announced that the Executive Committee request that all members of State Boards of Health, in attendance at this meeting, shall meet at four o'clock of the afternoon, in rooms which would be provided, at the Exchange and Ballard House, with reference to matters relating to coöperation between State Boards of Health.

Dr. Choppin, President of the Board of Health of New Orleans, next read a paper concerning the recent visitation of yellow fever in that city.

COL. T. S. HARDEE then explained the maps which had been prepared, and described the general situation and surroundings of New Orleans.

Col. Hardee described the system of drainage as being circumscribed on account of embracing only about one half of the superficial area within the city limits, or that district lying between the Metairie Ridge and the banks of the river. This drainage is performed by four draining-machines, which are located in a basin, to which point all waters from rains or otherwise accumulate to be pumped across and through the ridge into the basin of Lake Pontchartrain.

These machines are operated by both steam and water power; in the latter case employing wheels about thirty feet in diameter, which force the waters from within to a higher level beyond, very similar to an overshot water-wheel reversed. This system of drainage is totally inefficient to produce a good and satisfactory sanitary condition of the city, on account, principally, of the want of sufficient reservoirs to hold the accumulated water before it is entirely discharged.

There is no large city in the United States where there is so much demand for sanitary work, and where at the same time the natural disadvantages are greater, than in New Orleans.

Considerable time was devoted to the description of the manner in which the privy-vaults in the city are constructed, and the means used for emptying them. Owing to the nearness of the water to the surface, which is generally within two feet, it has been found that in a great many instances these privy-vaults, which are of brick construction, are subject to leakage, and that excrementary matter percolates through the surrounding soil, and during the heat of the summer's sun a great quantity of deleterious gases are exhaled from the surface. This may in time be corrected, when underground sewers can be established, and the refuse matter taken off through these new channels. Now, as a matter of sanitary reform, which can be accomplished without waiting for greater objects to be achieved, it has been proposed as a benefit to the open-drain system that during the summer months the city's streets should be irrigated by the water from the Mississippi River, which from the 1st of May to the 1st of August would flow of its own accord through pipes connecting with the river, the water during that period being higher than the gutter-ways of the adjacent streets. For the remainder of the year it is proposed that water be supplied for this same purpose of irrigation by means of stationary engines at intervals along the river-bank. This, it is claimed, will purify the atmosphere by converting each gutter-way into a rivulet, and at the same time cleansing the larger canals or drains by keeping water in them constantly pure.

A great many other points in regard to the sanitary engineering of the city of New Orleans were touched upon by the speaker, and illustrated by his system of maps, all to the end of showing the necessity of sanitary reform in this great southern city. The speaker also alluded to the fact, that although the sanitary condition of New Orleans is not such as could be desired, yet this recent epidemic of yellow fever was more virulent and prevalent to a greater extent in parts of the city that were entirely paved and well drained, than in those parts where even it was proved that garbage was thrown upon the streets, and in the immediate vicinity of the lowest canals and drainage-reservoirs.

Colonel Hardee has a map of each place visited by the Commission.

Dr. Richardson, of the University of Pennsylvania, next read a paper concerning the results of microscopical observations on the pathology of yellow fever.

Dr. W. G. Austin, of New Orleans, next read a paper concerning the epidemic of yellow fever in New Orleans in 1839.

Following this, Dr. Robert White, Jr., read a paper on "The Nature of Contagion: What is the Character of the Active Principle of Contagion by which certain Diseases spread, or are communicated from one Person to another?"

At the conclusion of Dr. White's paper, being at half-past two o'clock, the Association adjourned, to meet at half-past seven o'clock at Association Hall, Mozart Hall being otherwise engaged for the evening.

EVENING SESSION.

The following modifications of resolutions before presented, were referred from the Committee on Resolutions to the Committee on Legislation: —

1. *Resolved*, That the American Public Health Association very respectfully, but earnestly, urge the President of the United States to confer with the Spanish government, with a view to securing the appointment of an international commission of competent experts to investigate the cause of yellow fever at Havana, the principal place of its endemic prevalence, and to recommend measures for its prevention.

2. *Resolved*, That they respectfully petition Congress to appropriate a sufficient sum of money to conduct such an inquiry, on the part of the United States, in a thorough and exhaustive manner.

3. *Resolved*, That the President of the American Public Health Association for the ensuing year, and two other members to be appointed by him, constitute a committee to act in behalf of the Association to present these resolutions to the President and Congress, and to urge upon them the adoption of measures, by both governments in coöperation, for the prevention of the occurrence of epidemicy of yellow fever, so far as is possible, or at least its importation into the United States.

The following from the Executive Committee were presented for information of the Association: —

1. *Resolved*, That the several committees appointed to report on the communication made by the Yellow Fever Commission shall consider, and they are hereby instructed to consider, all of those communications as merely preliminary verbal statements, and not as formal reports or papers presented to the Association.

2. *Resolved*, That the chairmen of these several committees are hereby constituted a separate committee, and directed to prepare, with the least possible delay, a few brief, clear propositions with regard to the cause and best methods of prevention of yellow fever, to serve as a basis of discussion in the body of the Association.

The following report was then read by Dr. Billings: —

REPORT UPON THE WORK OF THE YELLOW FEVER COMMISSION.

THE Committee to which was referred the General Report of the Yellow Fever Commission has examined said report, and respectfully returns it to the Executive Committee with the following remarks: —

1. That it is evident that the Yellow Fever Commission has exercised great diligence in collecting data with regard to the late epidemic, and that its labors in this direction deserve the full approbation of the American Public Health Association.

2. That the preliminary conclusions presented by the Commission are in accordance with the prevailing opinions of the medical profession of this and other countries, with the exception of that relating to disinfection.

3. With regard to the method of investigation pursued by the Commission the Committee consider it as satisfactory, and in fact the only one which could have been employed, so far as the obtaining the history of this epidemic is concerned.

4. It is believed to be of great importance that the investigation thus commenced should be made as thorough and complete as possible, in accordance with the methods of the Commission.

But this Committee think it proper to observe that the investigation should take a much wider range, since what is desired is *to obtain, if possible, a knowledge of the cause of yellow fever, — a knowledge which the most complete history of the epidemic which can be made will not be able to furnish.*

What is it that we hope to accomplish when we undertake to investigate the cause of a specific disease? What will be accepted by the medical profession and the scientific world at large as being a satisfactory demonstration of the cause of yellow fever?

If yellow fever is, as we suppose, due to a specific material thing, some means is desired of recognizing the presence of that thing other than the fact of the occurrence of the specific disease in the human subject, — some test which will enable us to say, for instance, Here is a jar containing a substance which if inhaled or inoculated will produce yellow fever in a susceptible individual, and it will do this in any part of the country if applied under proper circumstances.

To establish the fact that the material in the jar would do this would require numerous experimental verifications, which cannot be obtained upon human subjects, and hence one of the first things to be sought is some animal or organism in which it may be possible to produce either yellow fever or some specific and recognizable effect of the yellow fever poison. In the accounts of yellow fever epidemics are various allusions to accompanying phenomena observed in animal life. For instance, it has been alleged that unacclimated animals at such times become sick; that certain insects are unusually prevalent; that insects do not annoy persons who have had the fever, etc. Certain analogies between the yellow fever and the Texas or Spanish cattle fever have been pointed out, etc., but as yet the test mentioned has not only not been found, but it has not been methodically sought.

It appears to us, however, that this is the first and most important step in the investigation, and that attempts to investigate the morphology, chemistry, and biology of the poison will be largely wasted until we have some easily applicable test to inform us as to when we have really got the poison to investigate.

Having such a test, the next step is easy. If the current theories about yellow fever are correct, the yellow fever poison may be developed by adding some one or more of the excretions or fluids of a person affected with yellow fever to decomposing organic matter under well-known conditions of temperature and moisture. We have then to carry out a process of elimination to find out what constituents of the decaying filth are essential and what non-essential, what secretions or excretions of the body are essential and what non-essential to the production of the poison, and at the same time to seek chemical or microscopical means of recognizing the presence of either the cause of the poison or the poison itself, in order to get rid, if possible, of the necessity of resorting to the physiological test of inoculation to prove its presence.

In this brief sketch of what would be considered a satisfactory demonstration of the cause of yellow fever, but one provisional hypothesis, namely, the prevailing and popular one, has been mentioned. Several others must also be considered and tested by the experimental investigator, but in each and all the greatest and first desideratum is an easily applied test of the presence of the poison.

It needs but a moment's reflection to see that the period when an epidemic is raging is not the time to carry on such researches.

They must be made when the disease is not prevalent, and yet there must be cases of the disease at hand in order to furnish the material for experiment.

Probably the best place to carry on such an investigation would be at first the city of Havana.

It must be clear to all that the necessary investigation will require much time and labor, and that its results should be presented accompanied by clear and convincing evidence. Such evidence will not be the opinions of any one, nor mere descriptions of microscopical appearances, nor even camera lucida drawings. Photographs, photo-engravings, the original preparations, and similar evidence will be demanded.

All of which is respectfully submitted.

J. S. BILLINGS, *Surgeon, U. S. Army, Chairman.*
J. BERRIEN LINDSLEY, M. D., *Nashville.*
S. OAKLEY VAN DER POEL, M. D., *New York.*
J. G. THOMAS, M. D., *Savannah.*
L. S. JOYNES, M. D., *Richmond.*

The following communication was then read by the Secretary: —

RICHMOND, *November* 21, 1878.

To the Secretary of the American Public Health Association.

Sir: Will you please read the accompanying letter to the Association, if you think proper, and say that I shall be pleased if physicians from the yellow fever stricken cities can give me the names and addresses of families of physicians who may be in need of help. I have already received $2,300.00 from the Citizen's Relief Committee of Brooklyn, for the relief of sufferers by the yellow fever.

Very respectfully, JOHN M. WOODWORTH.

The accompanying letter was as follows: —

BROOKLYN, N. Y., *November* 19, 1878.

DR. JOHN M. WOODWORTH, *Surgeon-general M. H. S.*

Dear Sir: I am in receipt of your favor 15th inst. with enclosure, contents of which are entirely satisfactory. Some time since we wrote you concerning the families of deceased physicians, victims of the pestilence. We have thought you might possibly know of some who from the same cause are incapacitated for properly supporting their families. To such and to the families of the former we would extend relief, and for that purpose herewith enclose you check for $500.00, with the wish that you might use the whole or part of it in such service. If in your judgment such assistance is not feasible, then dispose of the amount in such manner as you deem proper. Yours truly, RIPLEY ROPES, *Treasurer.*

Rev. Dr. Marshall, of Vicksburg, spoke in commendation of the letter. He recounted the suffering that existed in the yellow fever districts in the families of physicians, both of those who have fallen martyrs to their duties and of those, who though escaping death had lost all resources for the time being. It seemed to the speaker that something solemn, dignified, and entirely appropriate should be done by the Association, in connection with this communication either by committee or otherwise, but in any event to give it emphasis. Let the widows and the orphans know of that letter which has just been read in this assembly.

Dr. Hewitt endorsed the remarks just made, but thought it was well that the profession itself take into consideration the caring for families of deceased and needy physicians. He therefore moved that a committee of three be appointed to take into consideration what provision can be made by the profession for the relief of widows and orphans of physicians, who have fallen victims to the scourge of yellow fever. The motion was seconded, put, and carried.

Rev. Dr. Marshall suggested that Dr. Hewitt be made chairman of that committee.

Several names for membership were reported from the Executive Committee, and were duly elected.

At this stage of the proceedings Judge Meredith occupied the chair, and presided during the remainder of the evening.

Dr. J. L. Cabell then read the following communication from Hon. J Randolph Tucker, of Virginia: —

LEXINGTON, VA., *November* 19, 1878.

DR. J. L. CABELL: —

My dear Sir: In submitting my views, at the request of the Executive Committee of the American Public Health Association, upon the powers of the General Government to prevent diseases in the States, I must, for want of time for full consideration, be brief, and avoid any elaborate discussion of the question. It is one which is delicate and difficult: and we must take care to reach no conclusion which, while seeming to do good in the relief of our country from the recurrence of the dreadful pestilence which has recently afflicted the South, may disturb the just equilibrium established by the Constitution between Federal and State power.

The States have undoubtedly reserved to themselves the power to protect the lives and health of their people. The power, delegated to Congress, "to regulate commerce with foreign nations, and among the several States," cannot be constitutionally exercised, if thereby the introduction of disease into any State is either licensed or permitted. Unless this reserved power of the State to protect its people by quarantine and other health laws be upheld in full force, the commercial regulations of Congress might fill the avenues of trade with disease and death.

The commercial power is inter-national and inter-state, — external and federative in its nature, — for the regulation of which a general government is best fitted. The health power is local, domestic, and internal in its nature; operates within the State, and guards the homes of its people; and is best exercised by the State governments. As long as Congress regulates commerce, including in this term, if you please, navigation, and the instruments, machinery, and agents of intercourse with foreigners and among the States, it is legitimate and constitutional. But when it transcends the barriers which the States have reared to protect the lives and health of their people, it is without authority and unconstitutional. No State could safely leave to the central government the health regulations of the places within its borders. If the States have any exclusive power, it is here, — in the preservation of the health, physical and moral, of the homes of their citizens.

If the question be asked, Where is there any limit to the power of Congress over commerce? I answer, "In the terms of the Constitution itself." Commerce must be regulated by law. Congress can only pass such laws as are "necessary and proper" for the regulation of commerce. No law can be necessary, none can be proper, that is not, as Judge Story defines the word, "*bonâ fide* appropriate to that end," or which impairs one of the clearest of the domestic powers reserved to the States. No commercial regulation can be constitutional, therefore, which would abate in any degree the undoubted right of the State to preserve the lives and health of its people.

On this subject, the decisions of the Supreme Court are uniform, beginning with the case of Gibbons *v.* Ogden, 9 Wheaton, 1.

In that leading case, Marshall, Ch. Justice, speaking of the acts of Congress, which had recognized in their establishment of commercial regulations the quarantine laws of the States "*as flowing from the acknowledged power of a State to provide for the health of its citizens,*" states the question with clearness and force in the following language: —

"The acts of Congress, passed in 1796 and 1799, empowering and directing the officers of the General Government to conform to and assist in the execution of the quarantine and health laws of a State, proceed, it is said, upon the idea that these laws are constitutional. It is undoubtedly true that they do proceed upon that idea; and the constitutionality of such laws has never, so far as we are informed, been denied. But they do not imply an acknowledgment that a State may rightfully regulate commerce with foreign nations, or among the States; for they do not imply that such laws are an exercise of that power, or enacted with a view to it. On the contrary, they are treated as quarantine and health laws, are so denominated in the acts of Congress, and are considered as flowing from the acknowledged power of a State to provide for the health of its citizens. But as it was apparent that some of the provisions made for this purpose, and in virtue of this power, might interfere with and be affected by the laws of the United States made for the regulation of commerce, Congress, in that spirit of harmony and conciliation which ought always to characterize the conduct of governments standing in the relation which that of the Union and those of the States bear to each other, has directed its officers to aid in the execution of these laws, and has, in some measure, adapted its own legislation to this object by making provisions in aid of those of the States. But, in making these provisions, the opinion is unequivocally manifested that Congress may control the State laws, so far as it may be necessary to control them, for the regulation of commerce."

In another part of the same opinion, the great Chief Justice speaks of "quarantine laws, health laws of every description," as "component parts of an immense mass of legislation," "not surrendered to a general government, all of which can be most advantageously exercised by the States themselves." And this is quoted with the sanction of the same court in the case of Gilman *v.* Philadelphia, 3 Wallace, 726, decided in 1865.

It is true that in some of the late cases it has been hinted by some of the judges of that court that the legislation on all such matters by Congress would be more satisfactory (see Henderson *v.* Mayer, 2 Otto, 259); but the question has never been before that court for decision. nor has any judicial sanction been given to a departure from the doctrines stated by Chief Justice Marshall in the case of Gibbons *v.* Ogden.

And it is well to remember that Judge Marshall cannot be suspected of any strained interpretation of the Constitution in behalf of the reserved powers of the States. On the contrary, his opinions have always been considered as favoring a liberal construction of the Constitution in respect to the powers of the Federal Government.

But in his definition of the boundary between the commercial powers of Congress and the health powers of the States I think he was right, — and I would not recede from the position he has sanctioned: that health laws are not parts of the commercial power, but are an acknowledged part of the reserved powers of the States; and that every commercial regulation of Congress must respect and defer to the health laws of each State, passed for the protection of the citizen from disease. To deny this absolute power to the States, and yield it to the General Government, to be exercised or not at its pleasure and by its own methods, would not only be obnoxious to sound constitutional principles, but be perilous to the well-being of the people of the States.

But while I hold these views, I think we may find a practical solution of the question in the language of Judge Marshall: —

You observe, he says, that Congress "has directed its officers to aid in the execution of these laws" (of the States), "and has, in some measure, adapted its own legislation to this object *by making provisions in aid of those of the States.*" In other words, Congress should sustain the health laws of the States, and may make provisions in aid of them, but not against them, or contrary to their purpose.

As, therefore, Congress in its commercial rules has conformed to and assisted in the execution of the health laws of the States in previous legislation, it should do so in all future acts; and there is no reason why it should not, in its commercial regulations, embody such provisions for vessels and other instruments of inter-national and inter-state intercourse as in its judgment would promote the ends the States have in view, in preventing the introduction and spread of disease. Such laws, though not "necessary" for regulating commerce, would be eminently "proper" (in the constitutional sense); because, while they would be needful rules for commerce and for the good of the States, they would prevent the agencies of commerce, operating under congressional sanction, from invading the reserved authority of the States, and cursing with the scourge of pestilence the people upon whom they should bestow the blessings of commercial prosperity.

If therefore your Association could induce the States to adopt some uniform system of health regulations, it would accomplish much good. Nor can I see why such a result is not probable. Then, let Congress in its commercial regulations respect the health laws of the States, and wherein they seem deficient engraft upon the commercial rules it establishes such limitations upon trade as will conserve the health of the people by preventing the ingress or spread of disease. It is the privileges of commerce which create the danger to health. It is thus the power which grants these privileges that menaces the power which protects the health of the people. Congress, by limiting commercial privileges by its own rules, which will prevent the ingress or spread of disease, and respecting the health regulations of each State, will do all for commerce it should do consistently with the welfare of the people. In this way, it seems to me, the two systems of government under our federal system may constitutionally and harmoniously co-operate for the promotion of our commerce and for the security of the health of our people.

For it cannot be the interest of any State to obstruct its own commerce by needless and adverse health laws, nor can it be the policy of Congress to foster commerce by the sacrifice of the lives or health of the people of the State. Why may not both Congress and the States harmonize in concurrent action, within their respective constitutional functions, in the adoption of a wise policy, under the sagacious suggestions of the eminent medical and scientific men of the country? I confess I can see no constitutional difficulty to the adoption of a system of commercial and health laws in perfect harmony with each other, made legal by the sanction of the Federal and State governments.

If these views only avail to suggest some action for your Association which shall result in the good we all desire, I shall be gratified. I submit them with that hope, and with deference and respect for the opinions of others upon a subject on which there has been much discussion, but no judicial decision.

I am, with sincere regard,

Your friend,

J. R. TUCKER.

At the conclusion of this communication, by motion of Dr. Harris, a vote of thanks was tendered Hon. J. Randolph Tucker for the same.

Dr. E. M. Hunt, of New Jersey, then read the address of the evening, entitled "How to Study an Epidemic."

The Association then adjourned.

FRIDAY, NOVEMBER 22.

The President, Dr. Elisha Harris, in the chair.

Prayer was offered by Rev. Dr. Edwards, of Richmond.

The President announced that the first business in order was the election of officers for the ensuing year. Whereupon the following were elected: —

President, Prof. JAMES L. CABELL, M. D., University of Virginia, Charlottesville.

First Vice-president, JOHN S. BILLINGS, M. D., Surgeon U. S. Army, Washington, D. C.

Second Vice-president, SAMUEL CHOPPIN, M. D., New Orleans, La.

Treasurer, HENRY B. BAKER, M. D., Lansing, Mich.

The Secretary, Dr. E. H. JANES, continues in office.

ELECTED MEMBERS OF EXECUTIVE COMMITTEE.

C. B. WHITE, M. D., New Orleans, La.
T. J. TURNER, M. D., U. S. N., Washington, D. C.
E. M. HUNT, M. D., Metuchen, N. J.
J. D. PLUNKET, M. D., Nashville, Tenn.
C. F. FOLSOM, M. D., Boston, Mass.
C. N. HEWITT, M. D., Red Wing, Minn.

The Committee on Resolutions submitted the following report: —

The Committee on Resolutions respectfully report that they have duly considered the inclosed resolutions, presented by Dr. Henry B. Baker, of Michigan, in relation to obtaining legislation by Congress on several subjects pertaining to the public health.

While the Committee cordially approves of the subject matter of these resolutions, it still deems it inexpedient and unwise to commit the Association at this critical period of public agitation of kindred topics to any definite form of organization of a public health service. In our opinion, the objects sought can best be attained by the appointment of a suitable Committee on Legislation by the Association, which shall be empowered to secure the legislation necessary to the organization of an adequate public health service connected with the General Government. The Committee would suggest that in the organization of a legislative committee, each State represented in the Association should have a member, and that the chief medical officer of the Army, of the Navy, and of the Marine Hospital Service, and the Commissioner of Education, or such officer in their respective services as they may designate, shall be members, together with the President of the Association. This committee should have an Executive Committee conveniently located to act together during the session of Congress. To this legislative committee should be referred all resolutions or matters pertaining to Congressional action.

All of which is respectfully submitted.

EDWIN M. SNOW, *Chairman.*

The following are the resolutions of Dr. Henry B. Baker referred to in the above report: —

1. *Resolved*, That this Association heartily approves and earnestly recommends the adoption of the proposition of Surgeon J. S. Billings, U. S. Army, as set forth in a communication dated October 15, 1878, from J. K. Barnes, Surgeon-general U. S. Army, to the Hon. S. S. Cox, M. C., Chairman of the Committee on Census of 1880, and which proposition is, that statements of certain specified facts relating to the health of the people shall be collected in the coming Census.

2. *Resolved*, That the Secretary of this Association be directed to transmit a memorial to Congress, or a respectful communication to the Hon. S. S. Cox, M. C., Chairman of the Committee on Census of 1880, or to the proper officers who shall be charged with the control of the U. S. Census of 1880, setting forth the importance of having the statistics relating to the sickness and deaths, and all other vital statistics of the inhabitants which may be collected by the Census, collated, digested, and compiled, under the supervision of an expert in vital statistics and sanitary science; to the end that statistics collected at such cost and which are of such vital importance to the people shall not be made valueless by reason of unskilful compilation, but as useful as they can be made by a practical statistician familiar with the sanitary problems of the day.

3. *Resolved*, That, in the interests of public health and the prosperity of this country, it is desirable and important that the facts and data bearing upon public health subjects which are collected by the Census and constantly being collected by the several departments of the General Government at Washington, shall be systematically utilized and made practically available as aids to all proper efforts by Congress, Legislatures, Boards of Health, associations, and individuals, for the better protection of the lives, health, happiness, and prosperity of the people of the United States.

4. *Resolved*, That, for the accomplishment of the purpose suggested in the preceding resolution, this Association approves of the proposition for the formation of a permanent "United States Public Health Commission," charged with the duty of collating and utilizing all such information directly or indirectly relating to the public health as shall be gathered in the several departments of the General Government of the United States; this commission to make to the President or to Congress an annual report which shall embody such facts and information relating to public health as may be collected and be considered important to be included in such report, and otherwise to collect and disseminate useful information relating to public health in such manner as shall best advance the interests of the people of the United States, — the amount of money appropriated for such purposes being limited by Congress, and the Commission to be constituted as follows: —

The Surgeon-general of the Army (representing the War Department).

The Chief Signal Officer of the Army (representing the War Department).

The Surgeon-general of the Navy (representing the Navy Department).

The Surgeon-general of the Marine Hospital Service (representing the Treasury Department).

The Commissioner of Education (representing the Interior Department).

The Superintendent of the Census (representing the Interior Department), and

A permanent secretary and executive officer, who shall be a citizen of the United States, shall be chosen by the above-mentioned members of the Commission (but may be nominated by this Association), and who shall be selected for his executive ability, and especially for his expert ability in vital statistics and sanitary science, and whose duty it shall be to constantly attend to the duties of the office, and have immediate charge of the work of the Commission at the Capitol.

Whereas, Meteorological data of the right kind, and sufficient for the determination of the conditions under which yellow fever or any other epidemic occurs, have not been, are not now, and probably will not be collected, except it be done by the National Government; therefore, —

Resolved, That the permanent National Sanitary Commission should be especially required to utilize the meteorological data now collected, and to inaugurate a system of meteorological observations and reports by which it can learn the condition of the atmosphere at every season of the year in different parts of the United States, as regards relative amount of ozone, kind and amount of electricity, and such other facts of this nature as may promise aid in the study of the causes of epidemic and other diseases.

Resolved, That a committee, of which the President of the Association shall be chairman, be appointed to represent this Association on the subjects upon which Congress is to be memorialized; the duties of the committee to be, to consult with the officers whom it is proposed shall constitute the National Public Health Commission, and to frame a bill in accordance with the resolutions adopted by this Association, for presentation to the proper Congressional committee, and to present to such committee facts and considerations showing the national importance of legislative action inaugurating more effective measures for the prevention of sickness and deaths from removable or avoidable causes, and explaining more definitely than can be done in brief resolutions what is hoped to be accomplished through the establishment of a permanent National Health Commission.

Resolved, That the interests of public health and safety in these United States will be promoted by the establishment of State and National Examining Boards not connected with medical schools or colleges, but under governmental direction, whose duty it shall be to examine applicants for degrees in sanitary science and public hygiene, and to confer such degrees only upon such as on examination are found learned in such specialties; that this will promote accuracy in these studies, will stimulate many to become proficient, will create a demand for increased efforts for the teaching of sanitary science and such "knowledge of most worth" by schools and colleges, and, finally, that it will make it possible for State and city officers to select health officers and members of boards of health from a class of persons whose proficiency in sanitary science has been ascertained by those competent to judge.

Resolved, That in order to insure that such Examining Boards shall be formed of competent persons, such State Examining Boards shall be formed and controlled by the State Boards of Health, and the National Examining Board by the permanent National Public Health Commission; which may be economically done by the assignment of Army, Navy, and other medical officers of the government to act with sanitary experts from civil life (as suggested by Dr. Busey, member of this Association).

Resolved, That in transmitting to Congress the memorials and resolutions of this Association, the officers or committee of this Association shall include a repectful memorial to the United States Senate and House of Representatives, praying for the establishment of a standing committee on public health in each legislative branch of the government, and respectfully suggesting, as a reason therefor, that the needs of the people for protection to "life, liberty, and the pursuit of happiness" from preventable causes of sickness and death, are real and more constant than their need for protection from armed foes, against which the government protects by the Army and Navy, to which departments Congress gives much attention, in its general sessions as well as in its standing committees.

The following report of the Committee to whom Dr. Bemis's papers had been referred was read by the Chairman, Dr. Mitchell: —

The Committee report, that an examination of the documents submitted to it by Dr. S. M. Bemis shows that this gentleman has collected an amount of valuable evidence relating to the origin and development of recent epidemics of yellow fever at Canton, Miss.; Lake, Miss.; Vicksburg, Miss.; Port Gibson, Yazoo City, Miss.; Brownsville, Tenn.; and Milan, Tenn., which, in consideration of the brief time at his disposal, is truly surprising. This evidence is of the highest value, and should, in the opinion of this committee, be published at an early date, so that the facts elicited may be within the reach of those interested in epidemiology.

From a very hasty examination of this evidence, the committee cannot find that there are any uniform local conditions. Yellow fever has prevailed in cleanly places and in filthy places, in high places and in low places, among the rich and the poor.

Besides the constant factors of summer heat and atmospheric conditions common to the whole section in which the disease has prevailed, there seem to be but two conditions essential to the production of an epidemic. One, the introduction of the materies morbi from some foreign source, and the other, the presence of persons susceptible to the disease. It is noticeable that the first cases have, in several towns, occurred near the railroad depot or steamboat landing.

Some very interesting facts relating to the recurrence of cases in certain localities, soon after the hanging out of bedding, for the purpose of airing, which had been in use by yellow fever patients, are given in these reports.

The Committee is of the opinion that the work, so well commenced, should be continued under the auspices of the General Government, and would suggest that, in prosecuting this investigation, especial attention be given to the possibility of the infective material being conveyed in goods or clothing, other than the clothing or bedding of yellow fever patients, or by persons who, being personally protected, do not attract attention to themselves because of the fact that they do not fall sick with yellow fever.

(Signed) R. W. MITCHELL.
GEO. R. STERNBERG.
SAMUEL CHOPPIN.
C. W. CHANCELLOR.
R. S. KINLOCH.

It was moved that the incoming Executive Committee proceed at once with the publication of Volume IV., and also, as soon as practicable, with Volume V. of the Proceedings of the Association. Carried.

The committee to whom Dr. E. Lloyd Howard's report had been referred, then made report as follows: —

The committee to which was referred the papers of Dr. E. Lloyd Howard begs leave to report: —

That inasmuch as Dr. Howard's report is merely a preliminary and statistical one, and consequently incomplete, no action concerning it is at this time deemed necessary. The completion of the report is, however, of the greatest importance, with a view to its future publication by the Association.

JOHN MORRIS, M. D.
O. S. IGLEHART, M. D.
J. D. PLUNKET, M.D.
THOS. J. TURNER, M. D.
WIRT JOHNSON, M. D.

The Committee on Colonel Hardee's Report then reported as follows: —

RICHMOND, VA., *November* 21, 1878.

Your Committee appointed to consider the report referred to them beg to state that in their opinion the Map and description of New Orleans, as presented by Colonel Hardee, are valuable contributions of data to this Association, and should be embodied in a report of its transactions for future use and reference; that it is desirable to have this report supplemented by such details of topography, drainage, water supply, surface and underground street work, and modes of executing the same, as will enable this Association to study the exact condition of New Orleans in its relation to sanitary science.

They therefore recommend that Colonel Hardee be requested to submit to this Association a full written report, together with Map and profiles, embracing the views verbally explained to the Association this day.

They also recommend that similar data be solicited of other cities and towns within the yellow fever district; and that all maps and descriptions be arranged to accompany the special reports and observations made upon each city and town throughout the district under consideration.

Respectfully submitted,

W. E. CUTSHAW, *Chairman Committee.*

The Committee on subjects for discussion reported as follows, through Dr. Billings, chairman: —

The Committee appointed to prepare propositions on yellow fever to serve as a basis for discussion in the body of the Association, has the honor to submit herewith some queries for that purpose:

1. In case of the occurrence of an epidemic of yellow fever in a community unprotected by previous attacks, how are the well to be disposed of, and what organization and measures are desirable to afford relief?

2. When should yellow fever be declared epidemic in a community?

3. Can yellow fever be transmitted by personal contagion independent of clothing and fomites of every description?

4. Can yellow fever spread in a place which is and has been previously in a perfectly sanitary condition?

5. Can any known disinfectants be relied on to arrest the progress of yellow fever in a city or village?

6. What are the best methods of disinfecting?

7. What influence has the daily thermometric, barometric, or hygrometric range, or both, in promoting or retarding the spread of yellow fever in a community?

8. Are any measures of personal prophylaxis of service?

9. Is it possible and desirable to establish such a maritime quarantine for the Southern Atlantic and Gulf coasts of the United States as is necessary to secure immunity from the importation of yellow fever?

10. Is it possible to secure such a quarantine without placing it under the control of the General Government?

11. In case of the arrival of a vessel believed to be infected with yellow fever, what course should be pursued with the passengers, the baggage and freight, and the ship?

PROPOSITIONS.

1. Yellow fever is a specific disease, not indigenous to, or originating spontaneously in, the United States, and its appearance in this country is always due to a specific cause.

2. Quarantine established with such rigor and precision as to produce absolute non-intercourse will prevent the importation of the specific cause of yellow fever.

3. It is the duty of the General Government to aid in the establishment of a practical and proper quarantine by all means in its power.

4. It is the duty of the General Government to appoint a Commission of experts to make a thorough investigation into the causes of yellow fever, and the best

methods of preventing its introduction into this country, and to make such an appropriation as will permit of the securing the services of the best men, and of the best means for carrying out such investigation.

5. That it is the duty of the General Government to invite foreign nations to coöperate with it in the establishment of uniform and effective international quarantine regulations.

On motion the following additional proposition was added to the list: —

6. That whatever may be the practical value of quarantine, there is no doubt of the importance and value of internal sanitary measures in the prevention or modification of epidemic yellow fever, and that this Association strongly urges upon State and municipal authorities the great amount of responsibility which rests upon them on this account at times when no disease is prevalent or threatening.

On motion it was ordered that this list of queries and propositions be printed and distributed by evening.

Upon motion of Dr. Billings it was agreed to proceed to the consideration of resolutions which had been returned from Executive Committee. The Secretary then read as follows: —

1. *Resolved*, That in the deliberate judgment of this Association, it is the duty of every State to establish and adequately maintain an efficient State Board of Health, and to as great an extent as practicable to contribute to the protection of the public health within its own commonwealth, and by all suitable means to that of the whole country.

2. *Resolved*, That the powers and duties of the State Boards of Health should be so well defined by law, and so fully provided for in the polity of State administration, that the sanitary interests and protection of all places in the State should be secured.

3. *Resolved*, That a copy of these resolutions, with a suitable official memorandum as a basis of correspondence, shall be transmitted to each State Board of Health and each Governor in our country, to the health officers of ports, and to the government of each State and port, that may be concerned in the duties of such mutual efforts for sanitary protection.

Each resolution was voted upon separately after reading, and was adopted.

The following resolution, being of the same series, was referred by the Committee on Resolutions to the Committee on Legislation: —

Resolved, That in the efforts to obtain the aid or interposition of the Federal Government, for any general and specific kinds of sanitary protection of the United States against pestilential and infectious diseases, the State authorities should have effectual and prompt methods of united action to insure the desired sanitary protection and improvement, whether or not the national agencies lead, assist, or impart unity and effectiveness to the sanitary service of the States.

It was moved by Dr. Gihon, that discussion on the yellow fever papers, etc., be made the order of the day at one o'clock. Carried.

It was voted that the Constitution and a complete list of members be immediately printed, and two copies furnished to each member.

It was voted that in discussion gentlemen be limited to ten minutes each, until all who desire to take part shall have spoken.

The following resolution was read and adopted: —

Resolved, That a committee be appointed to advise with the Executive Committee of this Association with regard to matters of legislation coming before Congress during the next session, which relate to the subjects of Public Health, and that this committee be composed as follows; viz., one member from each State represented in the Association, the chief medical officer in the army, in the navy, in the marine hospital service, the Commissioner of Education, or such officer in these respective services as they may designate; and that to this committee be referred all resolutions and motions relating to the subject matter of the resolutions which have been or may be presented to this Association; the members of this committee to be appointed by the Executive Committee of this Association, after consultation as far as possible with the representatives of each State and the District of Columbia in this Association; and they shall report to the Executive Committee any advice which they may have to present. And this Association instructs the Executive Committee to exert its influence to secure such legislation as will best protect the public health of the whole country.

The resolution concerning the publication of the catalogue of the medical library belonging to the office of the Surgeon-general of the army was then taken up, and voted affirmatively.

Dr. J. S. Billings rose to make some explanations concerning a proposition originating with him in regard to incorporating into the national census of 1880 statistics of diseases as well as of deaths. The following resolution had been reported favorably from the Committee on Resolutions: —

Resolved, That this Association heartily approves and earnestly recommends the adoption of the proposition of Surgeon J. S. Billings, United States Army, as set forth in a communication dated October 15, 1878, from J. K. Barnes, Surgeon-general United States Army, to the Hon. S. S. Cox, M. C., chairman of the Committee on the Census of 1880, and which proposition is that statements of certain specified facts relating to the health of the people shall be collected in the coming census.

It was moved by Dr. Baker that the above resolution be passed by the Association in general session, thus relieving the Executive Committee of further consideration of the subject.

It was moved by Dr. Snow that a printed copy of the correspondence concerning this subject which Dr. Billings had read in the course of his remarks, and which embodied his scheme of questions, etc., be attached to the resolution.

The following is the correspondence referred to: —

WAR DEPARTMENT, SURGEON-GENERAL'S OFFICE,
WASHINGTON, *October* 15, 1878.

TO THE HON. S. S. COX, M. C.,
Chairman Committee on Census of 1880, Washington, D. C.

Sir: I have the honor to enclose a communication from Surgeon J. S. Billings, U. S. Army. It would be impossible to state in too strong terms the great additional value which his suggestions, if fully carried out, would give the next Census Reports, and I ask for them the favorable consideration of the Committee.

Very respectfully, your obedient servant,

(Signed) J. K. BARNES, *Surgeon-general U. S. Army.*

WAR DEPARTMENT, SURGEON-GENERAL'S OFFICE,
WASHINGTON, *September* 28, 1878.

GENERAL JOSEPH K. BARNES, *Surgeon-general, U. S. Army.*

General: I have the honor to submit the following suggestions with regard to the approaching United States Census, and to request that if they shall seem to you worthy of attention they may be brought to the notice of the Congressional committees which now have the subject under consideration.

Having been consulted on certain points relating to the Mortality Statistics of the last census, I have given special attention to their probable value as affording a means of judging of the condition of the public health, and of the prevalence of certain causes of disease in different localities, and, as a result of this examination, it appears to me that, interesting as they are, it would be possible to obtain data much more valuable, from both a scientific and economic point of view, in relation to the health of the people of the United States.

As is pointed out by the Royal Sanitary Commission of England, "however complete the registration of deaths may be, it cannot give a fair estimate of the sickness which is not fatal, it cannot indicate where or how these are to be prevented, it cannot tell the cost which is worth incurring for their diminution."

It is probable that results of the greatest interest and value might be obtained from a record of sickness, and especially of those forms which are known to be due to contagion or to special local conditions.

So far as I can learn the only attempts to obtain a registration of disease in connection with a national census have been made in Ireland, where the disease with which each individual is suffering on the day of the count is recorded; — and in Portugal, where a query is inserted as to sickness, but in what precise form I have not been able to ascertain.

As chairman of the section of Hygiene and State Medicine of the American Medical Association, I have corresponded with a number of the members of the section and with other skilled sanitarians, all of whom unite in the opinion that it is possible in the next census to obtain some data with regard to disease which will inaugurate a new branch of statistics in this country, and that it is highly desirable that the general government should take the lead in this matter.

The principal difficulty has been to obtain substantial agreement as to the questions upon which information is most desired, keeping in view the fact that these questions are to be asked and answered by unprofessional men.

As the result of the conferences above alluded to, and of careful study of what is practicable as well as what is desirable, I venture to suggest the following five queries as being, if not the best, at least such as will bring out a vast amount of information which will be extremely interesting and useful to the political economist, the sanitarian, and the physician.

The amount of information which moderately complete answers to them will give is not to be estimated from the questions themselves only; for it should be remembered that of each individual to whom these queries apply, the age, sex, color, parentage, and occupation are also recorded in the schedules now in use, and hence the influence of these conditions, separate or combined, upon the diseases to which my proposed queries relate can be made to appear in various ways.

The queries suggested are as follows: —

1st. Number of days during past year in which the person was unable to follow his or her usual occupation on account of disease (D) or injuries (I). (Attendance at school considered as an occupation.)

2d. Is the person sick on the 30th day of June, if so, name disease or injury.

3d. Is the case being treated in hospital (H), by a physician from a dispensary or public charity (C), by a private physician (P), or without a physician (N).

4th. Has the person during the past year had any of the following diseases namely: small-pox or varioloid (S Pox, V); scarlet fever (Sc): measles (Me) diphtheria (D); typhoid fever (T F); malarial fever (M F), (includes ague, bilious fever, and remittent fever); yellow fever (Y F); acute lung diseases (L D), (includes lung fever, pneumonia, and pleurisy); acute rheumatism (A R); cerebro-spinal-meningitis (C S M).

5th. What has been the cost to the person (or head of the family on his account) during the past year from sickness, in— *a.* Loss of wages or salary? *b.* Cost of medical attendance, medicines, and nursing?

These queries, for the most part, are self-explanatory. The second question is that used in the Irish census, the name of the disease being entered in the person's own words (in Ireland it is often entered in Irish) leaving it to an expert at the central office to classify it as best he can. The fifth query can, in most cases, be answered only approximately, but for the working classes, at all events, the answers will be near enough to the truth to be of value.

Very respectfully, your obedient servant,

(Signed) J. S. BILLINGS, *Surgeon U. S. Army.*

Dr. Hunt rose to oppose the first motion. He thought it was best to refer it back to the Executive Committee. The question was then put, with the amendment of Dr. Snow, and was lost. The resolution passed into the hands of the Executive Committee for further consideration.

Dr. S. S. Herrick, of New Orleans, read a paper entitled, "Propositions relative to the Etiology of Yellow Fever."

Dr. D. E. Halliday, of New Orleans, read a paper: "Is Efficient Quarantine Possible or Practicable?"

Dr. George M. Sternberg, U. S. Army, read a paper on the importation theory, and in favor of national quarantine.

Dr. Vandeman read a paper on Yellow Fever in Chattanooga, Tenn.

Medical Inspector Albert L. Gihon said: I desire to put on record the experience and the opinions based on that experience of the medical officers of the navy, which I am here to represent, by the authority of the Surgeon-general of the Navy. I believe them to be their unanimous opinions. If there are any dissentients, I have never met them.

1. The yellow fever ship is always a foul ship.

2. Foul ships, while often generating by their filth other endemic diseases, have never developed yellow fever *de novo.*

3. When a foul ship visits a port where yellow fever is prevailing, communication with that place will cause the development of yellow fever among its crew.

4. A clean ship may visit a yellow fever port, and by rigorously abstaining from all communication with that place, escape yellow fever contamination.

5. When yellow fever appears on board a ship, the only safety for the well is to get them out of the ship.

6. The sick can also be removed from the ship (provided clothing and bedding is not also removed) with entire impunity to those among whom they are received.

7. Nurses and attendants upon the sick, with yellow fever aboard ship, are not more liable than the other occupants of the ship to contract yellow fever.

8. When yellow fever appears on board a ship, it is possible to imprison it by fastening down the hatches, boarding them up, and imperviously caulking every outlet for emanations from below, the crew being restricted to, and sleeping in, the open air of the spar deck, abstaining from the use of food, drink, or clothing, which have been below.

9. If this ship is removed to a locality where bad sanitary conditions prevail and any of its contents discharged, it will inevitably disseminate yellow fever.

10. It is believed that localities to leeward of currents of air from a ship infected with yellow fever may be infected thereby.

11. Freight, food, baggage, clothing, etc., must remain undisturbed on board until the lower decks have been exposed to a prolonged continuance of extreme cold weather.

12. No ship on which yellow fever has prevailed can ever be safely inhabited until after a similar protracted exposure to freezing weather.

13. It is believed, but not entirely demonstrated, that thorough permeation of the ship by dry superheated steam will destroy the germ of yellow fever.

14. It is our belief that yellow fever is due to a specific living germ, of which the vitality may be impaired or wholly destroyed by extreme cold, and which germ rapidly propagates itself when deposited in a *nidus* of visible or invisible filth.

Rev. Dr. Marshall, of Vicksburg, said: In connection with the remarks just made I desire to suggest an inquiry, and I think the importance of the question will warrant the attention of this Association. Is it not possible, under circumstances which have been stated, to bring a ship alongside of the ship which has been battened down, and by artificial means freeze her? Cannot a ship by such means be frozen through and through? And if it is found, in such an attempt, that the degree of cold so produced in the infected ship has not been sufficient to penetrate through her entire contents, cannot her cargo be unloaded into a suitable building and there by artificial means be thoroughly frozen?

Dr. Porcher said: I wish to mention some facts. In 1858 there was a Spanish bark came into port direct from Havana, with four cases of yellow fever on board, the first that made its appearance in the harbor of Charleston. The vessel had a cargo of coffee. She was immediately quarantined. A vessel arrived from Bremen, on board of which there had been two or three cases of ship fever. This vessel was anchored about three quarters of a mile from the Spanish bark, off from the wind. The Bremen bark had seventy emigrants on board. They were immediately taken from the vessel and were not allowed to go up to the city, but were shipped into another vessel whose destination I do not know. After these vessels had remained in quarantine, the Spanish bark about one month, and the Bremen bark about three weeks, the captain of the Bremen vessel applied to the authorities to be allowed to go alongside the Spanish vessel and take out some ballast. The two vessels, contrary to the opinions of the port physician and myself, were allowed to go alongside of each other for two days. The ballast was transferred, and the vessels resumed their respective positions; but in a week thereafter the captain and four sailors of the Bremen vessel had died of yellow fever.

Dr. Turner recited the history of a ship which, after having had yellow fever on board, remained out of commission for a time, and was thoroughly overhauled. Afterwards, in service, after having crossed the Atlantic, but without any new exposure to yellow fever, although stopping at Port Graytown, where malarial fever was prevailing at the time, yellow fever again broke out on board. The ship was again taken out of commission, and remained exposed for two or three winters. Being re-commissioned, during her first cruise yellow fever again appeared on board.

Rev. Dr. Marshall: I do not suppose that is any answer to my suggestion that we ought to freeze ships?

Dr. Selden, of Norfolk, then read a paper on "Prevention of Yellow Fever."

The Association then adjourned.

EVENING SESSION.

The President, Dr. Harris, in the chair.

The President announced the Committee which had been elected to petition Congress for the publication of the Index Catalogue to the Library of the Surgeon-general, U. S. A., as follows: Dr. R. W. Mitchell, Tennessee (Chairman); Dr. H. I. Bowditch, Massachusetts; Dr. S. M. Bemis, Louisiana; Dr. Wirt Johnson, Mississippi; Dr. Henry B. Baker, Michigan.

The Secretary then read several names of persons proposed for membership, who, on motion, were elected: Governor Carrol of Maryland; Dr. A. M. Fauntleroy, Staunton, Va.; James H. Gilmore, Marion, Va.; Mrs. Elizabeth Thompson, New York; Dr. J. R. Ward, Maryland.

The Secretary then read the resolution, providing for an Advisory Committee, adopted at the morning session.

The President then announced the following Committee Advisory to the Executive Committee on National Legislation: Dr. R. H. Webb, Alabama; Dr. Henry Gibbon, California; Dr. J. P. Wall, Florida; Hon. J. G. Thomas, M. D., Georgia; Dr. J. H. Rauch, Illinois; Dr. Geo. Sutton, Indiana; Dr. Wirt Johnson, Mississippi; Hon. L. H. Steiner, M. D., Maryland; Dr. H. I. Bowditch, Massachusetts; Dr. J. Howard Taylor, Pennsylvania; Dr. Thomas C. Minor, Ohio; Prof. J. T. Hodgen, Missouri; Dr. E. M. Snow, Rhode Island; Dr. T. A. Atchison, Tennessee; Dr. L. S. Joynes, Virginia; Dr. H. O. Hitchcock, Michigan; Dr. J. C. Reeves, West Virginia; Dr. Joseph M. Toner, District of Columbia; Hon. Dorman B. Eaton, New York; Dr. Robert Libby, South Carolina; Dr. Thomas F. Wood, North Carolina; Dr. G. C. Chamberlain, Connecticut; Dr. S. P. Conn, New Hampshire; Dr. H. D. Holton, Vermont; Dr. A. R. Kirkpatrick, Texas; Dr. E. L. Griffin, Wisconsin; Dr. D. W. Hand, Minnesota; Hon. Samuel Lilly, M. D., New Jersey; Dr. R. G. Jemings, Arkansas; Dr. T. A. McParlin, U. S. Army; Dr. B. F. Gibbs, U. S. Navy; Dr. S. Hebersmith, U. S. M. H. Service.

The Secretary read Dr. Billings' resolution concerning health statistics, to be incorporated in the new census, which had been acted upon by the Executive Committee. On motion, it was adopted by the Association.

Dr. Steiner then offered the following resolution, which was adopted: —

Resolved, That a committee of three be appointed to urge upon the Special Committee of Congress, now engaged upon the organization of the next census, the great importance to public health of the subject of the above resolution.

The following gentlemen were appointed upon said Committee: Dr. L. H. Steiner, Dr. E. M. Hunt, Dr. Elisha Harris.

The Committee to which was referred the Report of Dr. Cochran presented the following report: —

Your Committee to which was referred the Report of Dr. Jerome Cochran, covering his investigations in Osyka, Port Eads, McComb, Jackson, Grenada, Water-Valley, Holly Springs, and Grand Junction, Mississippi; Decatur, Alabama; and Chattanooga and Memphis, Tennessee, note —

First, The Herculean labor performed in so short a time.

Second. The great number of facts bearing on the spread of yellow fever, by which the scientific literature of the subject is enriched.

But your Committee have not failed to recognize the tentative character of the investigation, in the absence of thorough observation of those meteorological and terrene conditions which it is to be hoped may ultimately enable us to determine why the germ of yellow fever will fructify in one locality and not in another.

We earnestly recommend that the labors of an investigator, so able and zealous, be continued until all the facts are gleaned from this vast field of observation.

T. A. ATCHISON, *Chairman*.

The President called attention to the proposed amendments to the Constitution reported by the Committee on the President's Address, which are as follows: —

PROPOSED AMENDMENTS TO THE CONSTITUTION.

This notice of the proposed change in the Constitution is given in accordance with Section XIII.

Article III. to be amended so as to read as follows: —

MEMBERS.

There shall be two classes of members, viz.: (1) the members of State Boards of Health, ex officio; (2) elected members who shall be selected with special reference, etc.

IV. to be amended so as to read as follows: —

OFFICERS.

IV. The officers shall be a President, a Vice-president, a Secretary, a Treasurer, and a Foreign Corresponding Secretary.

All the officers shall be elected by ballot, annually, except the secretaries, who shall be elected for a term of three years.

VIII. to be amended so as to read as follows: —

THE COUNCIL.

VIII. There shall be a Council, to be composed as follows, viz.: Of the President, the Vice-president, the Secretary, and the Treasurer, and of one member from each State Board of Health as appointed by said boards, and of an equal number of members to be elected by the Association, and a representative from the medical service of the Army, of the Navy, and of the Marine Hospital Service.

THE EXECUTIVE COMMITTEE.

IX. There shall be an Executive Committee which shall consist of the President, the Vice-president, the Secretary, the Treasurer, the past Presidents, and five other persons whom the Council shall elect from their own number, at least two of whom shall be from the elected members of the Council. Five members shall constitute a quorum of this Committee.

IX. to be amended so as to read X.

THE DUTIES OF THE COUNCIL.

XI. The Council shall at each Annual Meeting make to the Executive Committee any recommendations it may deem proper. It shall also obtain such reports from State Boards of Health and from States not having boards, as shall secure the objects of the Association.

XI. amended so as to read XII.
XII. amended so as to read XIII.
XIII. amended so as to read XIV.
XIV. amended so as to read XV.

It was stated that according to the provision in the Constitution, these proposed changes would be printed, and promptly placed in the hands of members for consideration against the next annual meeting, when they will come up for vote.

The following resolution, proposed by Dr. Chancellor, of Baltimore, was then adopted: —

Resolved, That the American Public Health Association returns its grateful thanks to His Excellency the Governor of Virginia; to the local Committee of Arrangements, and the citizens generally of Richmond; to the press of this and other cities, and to the authorities of the various lines of railway, for the courtesies which they have respectively extended to the members of the Association, especially the authorities of the Piedmont Air line, which gave free transportation each way to all members and delegates traveling over their road between New Orleans and Richmond.

Dr. J. D. Plunket, of Nashville, then read a paper on "The Disinfection of Sewers by Ozone."

Dr. Austin spoke as follows: I propose, in addition to the facts given by Dr. Choppin, President of the Board of Health of Louisiana, to give some further statements in regard to the *Emily B. Sudor*, which brought yellow fever to New Orleans this year. We have the statement made by Dr. Choppin, and corroborated by statements made by one of the ablest and most experienced sanitarians in the country. Dr. White was President of the

Board of Health for a term of seven years. These gentlemen were trained to investigate the subject of yellow fever, and they certainly have taken great pains to investigate it. Dr. Choppin gave almost his entire attention for months, before we left New Orleans, to obtaining all the facts. He certainly has given them, as I understand them, with perfect correctness. My friend Dr. Holliday stated, in the paper he read to-day, that he was not quite satisfied himself that yellow fever was brought by the *Emily B. Sudor*. Gentlemen, Dr. Holliday is one of our experienced yellow fever physicians. If he had seen these cases I am very sure he would have pronounced them both yellow fever. He stated that a physician upon whom he relied greatly attended Elliott. That physician, to my certain knowledge, was never in an epidemic of yellow fever. He was in Europe during the time of our last epidemic, in 1867, and since Clark's death he was stricken down with the fever himself, and came near dying, and is now in Europe. So much for his testimony, in contrast with that of Dr. Choppin, who has spent over a quarter of a century in investigating the disease. To my certain knowledge Dr. Choppin has made over one thousand autopsies of yellow fever. He never lets a case pass in the Charity Hospital, and in the Medical Department of the University of Louisiana, that dies of yellow fever, without an autopsy. He was constantly teaching among the students, giving them clinical lectures upon yellow fever. His practice outside has been very extensive. If I were to pick out any man that I think knows yellow fever, and has an experienced eye to detect it, I would select the President of the Board of Health of Louisiana. I make these remarks that you may all know that what he has stated he knows to be facts, and you, gentlemen, are looking only for facts. You get them in his report.

The other physician that my friend Dr. Holliday states attended Mr. Clark, he calls an old and experienced physician. He was not living in New Orleans when he attended this case. He got on board of the vessel at the mouth of the river and came up with her, and his being on board was what allowed the vessel to pass quarantine. The man was in a stateroom, saying he was only slightly ill. But how did this physician treat him? It was for yellow fever. Every remedy employed was for yellow fever. He even wound up with champagne before he died. Now, gentlemen, I propose in my paper to continue the subject so far as the epidemic of 1839, to prove that there were more cases imported in 1839 than there has been in any year since yellow fever made its appearance in the United States. I have been induced to do this because my friend from Charleston thinks, probably, yellow fever originates there.

Dr. Hewitt then read from the paper referred to by the previous speaker, until the expiration of his allotted time, ten minutes.

Rev. Dr. Marshall, of Vicksburg, again took the floor, and first gave an account of what he called "clerical interference in the sick room." He said that for himself he never went into a sick room unless the patient personally desired to see him. It was not enough that the friends of the sick desired him to come. His experience in various epidemics of yellow fever was that the spread of the disease could always be traced from house to house. Sometimes when a gap was found in the chain, and no explanation could be readily given for the disease skipping quite a distance, perhaps passing clear over a hill, the fact that a dog had passed between the two houses supplied the missing link. "A Newfoundland dog can carry yellow fever poison just as well as a man can. Every dog in the city carries it about with him."

Dr. Dowell spoke as follows: I have made myself familiar with yellow fever, and have put my opinions upon record. One among the first is as to the introduction of yellow fever into this country. It has been fully proven that it is exotic to the United States. I can prove that it is not indigenous to Brazil. It has been spreading through that country at different intervals since 1849. Hence my introduction of a resolution concerning a conference with the South American States. It has been carried to Spain also. Its home is not in the West India Islands. Its home has not been discovered. It spreads like small-pox. It does not spread longer than ninety days sporadically. It does die out in ships. I have proofs that it has died out — disappeared for ten years. I am astonished at some things I have heard here. I spoke of these things in the introduction of a resolution the other day in reference to the spread of the disease from the human body. I am prepared further to sustain that resolution — particularly the latter part of it — that you may introduce it into perfectly clear and pure air, and it will be immediately destroyed. Gentlemen say it is clothing, trunks, steamboats. Do people carry it in their satchels and clothing? No sir. You tell me that the body does not develop and reproduce the disease. Where does it come from? The body does develop the poison. I do not see how it is possible to reason to any other conclusion. I cannot understand it in any other way.

Dr. Gihon explained the advantages of superheated steam as a means of disinfection. He said the great advantage consisted in the fact that superheated steam was dry, retained its heat, and was not so readily condensed.

Dr. Bell spoke as follows: I came here hoping for just what I have been able to get, — learning something about this epidemic. A little more than thirty years ago I was thrown into the midst of a severe epidemic in the vicinity of Vera Cruz, during the time of the Mexican war. I saw such local conditions as have since satisfied me that it is perhaps a daring act to come here to say anything against the prevailing judgment of this convention. Since that time I have seen several other epidemics. I have studied the topography of yellow fever. I have read everything concerning it I could get hold of for thirty years. My friend has not gone back further than I intend to go. One distinct recollection that I have is, that the earliest yellow fever I have read of, and which killed a great many people in America, was described in a Spanish history of the West Indies. As early as 1494 Columbus' community was decimated in San Domingo by yellow fever.

Dr. Gihon has spoken of the impossibility of killing fever on board ship except by dry heat of a high degree. He is familiar, I think, with steam heat.

It is possible to kill the germs of yellow fever under certain conditions at a less temperature than 220°. (Dr. Bell here related an instance in illustration of disinfection by steam in 1848, in which he had steamed a vessel to rid it of vermin, at a time when yellow fever prevailed, and had rid the ship of the latter as well as the former by the operation. Since that time steam heat has been applied by himself and others, at many times for the special purpose of disinfecting vessels of yellow fever, and so far as he knows without failure in a single instance. He expressed his surprise that it had not been used on board the ill-fated *Porter*.

Dr. Stuart said: I want to make three points in reference to the management of cases of epidemic yellow fever:—

1. Immediately remove the inhabitants from the houses where fever breaks out.

2. Burn the clothing,—everything woolen or cotton that was in these houses in contact with any one either sick or well.

3. Isolate the district. Keep every one out of it until after a frost.

I think these three points are of extreme importance and quite sufficient, as proven by experience in Baltimore, to prevent the spread of disease and to stamp it out entirely.

Dr. Bell rose to make some statements concerning quarantine. He said: I have been studying quarantine for twenty years, and I want to say something about this special proposition. We have no sufficient inspection against foul vessels. We allow them to go to sea filthy. Vessels may clear, even from the port of New York, and an epidemic break out on board the next day. No inquiry whatever is made upon a vessel's leaving a port. We should have a quarantine of debarkation, and intelligent quarantine inspection. Now concerning the disinfection of ships, etc., by steam. The question is the degree of heat. Yellow fever will not occur anywhere after it has been heated up to 180° for two hours.

Major Walthall said: I desire to speak on two questions. I am no physician. There are some facts in this connection upon which laymen have as good opportunities and perhaps better, to form opinions, than physicians themselves. What I shall say is from an experience of over twenty-five years' service in one or another of the benevolent organizations for help in cases of yellow fever. I have seen nearly all the epidemics which have prevailed in the south during that period. The facts in each case, in some respects, differ from the others. The lessons drawn from one epidemic are different from those drawn from another. My personal observation began in 1853, in Mobile, and has continued through the several visitations up to that of the present year.

In the year 1855, when the fever broke out in Norfolk, the citizens fled to Baltimore and various other places, and in no single instance did they communicate disease to persons where they went. No person died except those who had been in the place. If we were to deduce a conclusion from this instance it would be that yellow fever is not communicable at all. You know what our experience with it has been this year. It is certain that the phenomena differ. Some other condition is necessary for the propagation of yellow fever besides impurities. Can yellow fever spread in a place which has been previously in proper sanitary condition? It has seemed to be assumed that perfect sanitary condition would check yellow fever. My experience upon this point is to the contrary. Where yellow fever has prevailed worst has been in the cleanest places. Not only that, but comparing the condition of a place in the year in which yellow fever prevailed with its condition in other years, it has been found to be much cleaner at the time yellow fever became epidemic there than at any other time. The same thing is true as to the various localities in a city. The unhealthy districts of a city, as regards ordinary years and circumstances, are the most exempt from yellow fever. This is simply my experience. I have no theory to offer. The only thing that I consider established is that sanitary conditions have no effect whatever. It should not be assumed that the excellent sanitary condition of a place has any effect in checking yellow fever. In Mobile, in 1853, we had ample notice of the approach of the disease. It broke out in New Orleans in June. It did not break out in Mobile until the 12th of August. During that interval every means was put into operation to prevent the disease. Thousands of dollars were spent in cleaning the city. Fumigations were employed. Every known precaution was taken against the disease except quarantine. Notwithstanding all this it came and spread, and the city was swept by the very worst form of the epidemic. Memphis was no worse in 1878 than in 1875, although it generally is a dirty place. The same thing is true of Holly Springs. The city of Pensacola is remarkably clean. It is built upon a bed of clean sand and has no filth. Yet yellow fever has prevailed there in its severest types.

Dr. Sims, of Chattanooga, said: I desire to call attention to some of the points in the paper read by Dr. Lindsley. He referred to the cleanliness of these places. Whenever a case of yellow fever occurred they picketed it at once and isolated it. This plan worked well. It seemed to the people, however, that they escaped the yellow fever because they were so clean. If you will compare facts in our town of Chattanooga, I think you will find that some weight should be placed on the fact of quarantine. I can give numerous instances in proof of the efficiency of disinfectants. When a case was once recognized as yellow fever, the family was removed, the house was quarantined, cleansed, and shut up, and absolutely filled with the fumes of burning sulphur. From such instances we could trace no cases of yellow fever. I might mention other instances of houses being successfully quarantined, and again, where quarantine and disinfectants together were disregarded, and the disease spread largely. I submit that the true protection from yellow fever in Nashville was not owing to the extreme cleanliness of the city, but it was owing to the system of internal quarantine put into operation. You can rely upon that always. We are not the most cleanly people in the world, in Chattanooga, but for all that we don't like to have dirt thrown at us by our neighbors. And we do not believe that our filth gave us yellow fever.

Dr. Dement said: You have heard from the papers and speeches of the gentlemen present, something about yellow fever almost everywhere it has prevailed, except from my little town of Huntsville, Ala. Probably it would be well for me to give you a short account of the yellow fever in that little town. My friend, Dr. Holliday, alluded to it in his paper. On the 27th of August the first case was introduced into the place, in the person of a refugee from Memphis. She arrived at eleven o'clock at night and went to a boarding-house in the filthiest portion of the town. I saw her with the black vomit on the 28th, and she died on the 29th. The people of our town, like all towns where yellow fever was introduced, became panic stricken, but none left the city. This victim was buried. The bedding was burned and coal-tar was burned around the premises. Carbolic acid was also freely used. The house was deserted by its inmates. No one was allowed to occupy it for three weeks. About three days afterwards a second case developed in the person of a nice young man, — another refugee from Memphis. He was sick at the house of an aunt of his, who was unwilling he should be removed to the hospital. He was allowed to remain with his aunt, was sick about ten days, and recovered. There were in that house six persons. Two ladies and three men and a colored man, which together with myself made seven persons, who attended the young man throughout the whole attack. No case of yellow fever developed among that number of persons. From that time up to the first of November twenty-four cases of yellow fever were introduced in a similar manner into that town. Nineteen of these I had sole management of. They were treated in the private houses of the city, and in the hotels. Five cases were removed to the infirmary. Of these three recovered and two died. Every hotel in the place had more or less yellow fever. There was no stampede among the boarders. When the disease was first introduced our people would not go near it. It was difficult to get physicians to go. Towards the last they began to see it was not so dangerous as they first thought. I had in several instances to insist upon visitors staying out. At the time I left home there was but one case of yellow fever in the town. That victim has since died. From the 27th of August to the first of November, we had in all twenty-four cases. No day in that time was our little town entirely free from yellow fever; no day in that time that I did not visit a yellow fever patient. The question of quarantine came before our Board of Health; then before our City Council. Both decided not to quarantine. Our doors were left open to the refugees from the stricken cities. First Memphis, then Grand Junction, etc. We had refugees from all those places. There was no restriction whatever upon travel or commerce. Goods of all kinds, bedding, clothing, everything, passed over the railroads into our town, — express mails, — everything. When the disease became epidemic in Memphis, the Memphis and Charleston Railroad shops were broken up, and I think about fifteen or twenty families, with their luggage, trunks, etc., were moved into our town. From Tuscumbia the same thing took place. One case developed on the train that brought the people out. Seven cases developed from one car-load of passengers from Tuscumbia. It has been a question with me, and I came here to hear it answered, — I would like to know why the disease attacked Decatur, twenty-two miles from us, passed through our town, and lodged at Chattanooga.

We did not have our cases isolated. They were treated from the lowest house to the finest hotels. I have endeavored to answer the question in my own mind why the disease did not prevail in Huntsville, and I attribute it to the sanitary condition of the place.

Dr. E. Lloyd Howard said: In the first place, I wish to say a few words in reference to this question of internal quarantine, and also in explanation of the fact that yellow fever occurs in localities where we cannot account for its appearance and where we cannot easily trace it. On the 3d of October I entered the depot at Cincinnati. I saw a lady and gentleman, from some point in New York, come to the porter of the sleeping-car and ask if there was any danger of the yellow fever. The reply was, "No; the cars stop fifty miles north of New Orleans." The lady and gentleman went to bed and wrapped themselves in the blankets. They got out in Northern Tennessee, and taking a coach went to their homes. I was quite well assured that the statement of this porter and conductor were false, and that yellow fever had been in that car. If yellow fever had broken out at that point in northern Tennessee, how were you going to trace it? At Water Valley the train stopped, and in conversation with two physicians, I was assured by them that fifty cases had been put into that identical car and carried along that line during the summer. I went further. Reached Macomb City — found a commotion in one end of the car, and ascertained that there was a sick man in the early stages of yellow fever. At Osyka another man was brought in with yellow fever. I was assured by the officials of the road that this had been going on all along the line of that railroad, and because they stopped the cars fifty miles north of New Orleans they claimed that they were not infected. After this, tell me that yellow fever breaks out *de novo* in a given place, and that it was not carried there by some direct transportation, or that the patient had not been in contact with yellow fever! Where quarantine is established, and where yellow fever comes in spite of it, it does not follow that therefore quarantine is of no avail. There is a difference between effective and ineffective quarantine. I saw in Jackson, Miss., where the train was halted a mile from the town, a negro nurse coming from Holly Springs with a bundle of clothing in her arms, jump off the train and sneak up an alley. Where is your quarantine? An efficient quarantine will keep out yellow fever, but an inefficient quarantine will not. Dr. Holliday has intimated that the Yellow Fever Commission went out to seek arguments to sustain the contagiousness of yellow fever. Dr. Morris has read a statement that in Baltimore it did not, in one single instance, spread from one person to another. I sustain that fact. Having had such experience, and with the natural presumption that I would not be a strong contagionist in this matter, I went to Louisiana. I visited nine different towns and cities, and in not one single case did I fail to trace direct communication. Moreover, I found that whenever a case of yellow fever existed in one of these houses, in not one case out of ten did it fail to spread to other members of the family. I traced twenty-five cases in each village, and found in every single instance presumable evidence. I do not mean to say that I found scientific or absolute proof, but presumptive evidence, that the person had been exposed to contagion. I did not accept village gossip as proof. I traced cases carefully and sifted the evidence, and for even one page of notes that I have preserved there are four that I have destroyed. In my journey through the South I only found three physicians who held to the theory of non-contagion, and not less than twenty-five who assured me that up to this time they had been strong non-contagionists, but they had been compelled to change opinion. When I found these facts, and when I found nothing of a contradictory nature, — and I searched patiently, — I could not but come to the conclusion that yellow fever is unquestionably a contagious disease, under certain circumstances. What those circumstances are is a question for us to study. I will not venture the expression of an opinion at this time. I found that it was not in the most filthy parts of a city that yellow fever originated. It was not in the most filthy parts where it was most malignant. It seemed to be no respecter of persons or places. Another point; that is the element of time in the propagation of yellow fever. We have heard a great deal about the propagation of the germs of the disease. As soon as my patient dies, I have him buried, and immediately have all of his bedding — everything that was about that man, everything abont the wood or iron-framed bedstead — burned. If the man convalesces and gets well, I have him removed to another room, give him a bath, put on fresh clothes, and burn up every stitch of his old clothes. I do not let these old things accumulate. It has occurred to me that if I would let this clothing and bedding remain for a certain time, then would there not be some danger of the propagation of yellow fever, and may it not be that we have owed our immunity, to a certain extent, to this fact? I would like this element of time in the generation of yellow fever germs, if they be germs, taken into consideration.

As to the work which has been done by this Commission, at least by myself, the work done in New Orleans was not effective. I never expected positive results in large cities. In small towns and villages I looked for our best results. From the 23d of October to the 15th of November we were traveling as hard as we could, — working day and night, — taking notes and testimony, having, in some instances, to go to special exertions to make sure we were receiving authentic information. Once I rode four miles into the country, in order to verify by the colored man himself certain statements that had been made to me. I would take nothing second hand. Working in this manner, day and night, with our rough notes before us, we spent until the 15th of November. I had to be in Richmond on the 19th of November, and present the results of my labors. With this short time for preparation we came before this Association, to make our showing. I think that when we have had time to digest and arrange the mass of testimony we have gathered, that this Association will not be disappointed. Further, it should be understood that our labors — at least my own — were confined to a few specific points. We investigated, in the first place, the topography of the locality, its sanitary conditions, drainage, etc.; next, as to the location of the first case; third, as to whether the patient had any contact with known infected persons or places; then did the second, third, or the fourth case have communication, direct or indirect, with the first patient, or with some other patient in another locality, and so tracing up the cases until we got from fifteen to thirty scattered over the town. We would then cease our labors at that place.

I would like to corroborate the statements of my friends Drs. Morris and Stuart, in relation to stamping out yellow fever at Baltimore. I wish to impress it upon this Convention that I rely upon the Health Officer of the City of Baltimore, more than I do upon the quarantine. In other words, we cannot maintain an efficient quarantine without destroying the commerce of the city. In Baltimore, when our patients swelled up to seventy-five or eighty, owing to our prompt and efficient action, we broke up that epidemic by moving everybody, sick and well, burning every article in the houses, curtains and carpets included. We moved every living soul from the locality, and carried them down to quarantine station, and there we treated them. I believe that with a quarantine as rigid as may be, according to the latitude we happen to occupy, supplemented by an efficient health officer, — I believe these are our best means of preventing the advent of yellow fever.

Dr. Atchison said: Mr. Chairman; if the utterances of members of this Association shall go out to the world assuming definite shape, as they have been advanced and expressed here, that the filthiness of a community has no influence in the spread of yellow fever, without challenge, it will paralyze all sanitary effort, especially in communities where it has just begun to attract attention. If filth prevents disease, — better have more of it. Better pile up more filth in the streets. I do not think men really mean this. The speakers who have preceded me have shown some of the defects of quarantine. You will never get a perfect quarantine. The temptation to elude it will always lead to its evasion; but let us take it for what it is worth, — get all out of it you can. I insist upon internal sanitation, including the deportation of population, and other vigorous measures, — arbitrary, exacting, tyrannical, — because the occasion justifies such remedies. If this great destroyer — and it might almost be called a plague — is ever to be successfully combated, we must arouse and concentrate individual coöperation, every state effort, every national effort, because it is a foeman worthy of our steel. You may exhaust all your resources and still not be able to subdue it. I do not think that the demand for measures of that kind is excessive, when the degree of danger that threatens is considered. If all the armies in the world were threatening your Gulf States, the first call would rally the men of the country to the rescue. Yet you are now threatened by a far worse enemy, and one which should be met by like effort. I am exceedingly anxious to hear this filth matter discussed in a manner more full of detail and more full of facts than I am able to give it, and therefore I will leave the floor for the balance of my time to Dr. Bell.

Dr. Bell said: I took special interest in Colonel Hardee's explanation of the map of New Orleans. The low lands were subject to overflow, and the better lands of the region were subject to a wetting and drying process. I have always found that marshes and swamps are the worst places for diseases. Cleaning off the surface dirt don't make the place clean, and I know of many cases where clean places were occupied by persons who brought the disease with them without communicating it to other persons. I should be sorry to think that any one could believe that with filth they might be indifferent. Let it never go abroad that filth is to be indulged because in some one place it did not happen to be heated enough to make it develop disease. It takes something more than mere surface cleaning to make a place clean. Filth saturates the soil. Heat and moisture following, promote putrefaction and the development of disease.

The propositions which had been prepared and printed were then called up for vote.

A motion was made to postpone all consideration of the first proposition until a year hence, or until the meeting to be held at Nashville. Motion was lost.

A motion was made to lay it upon the table. Ayes, 14; noes, 20. Motion lost.

Several modifications of the first proposition were proposed, resulting in the adoption of the following substitute, offered by Dr. Gihon and seconded by Dr. Choppin:—

"Yellow fever, in 1878, was a specific disease, not indigenous to or originating during that year in the United States, and its appearance in this country was due to a specific cause."

This proposition was then put to a vote, resulting as follows: ayes, 33; noes, 10.

The other propositions were then voted upon separately, with the following results:—

Second proposition, ayes, 31; noes, 7. Third proposition, ayes, 37; noes, 1. Fourth proposition, ayes, 35; noes, 0. Fifth proposition, ayes, 35; noes, 0. Sixth proposition, ayes, 40; noes, 0.

Dr. Snow then offered the following resolution, which was unanimously adopted.

Resolved, That the heartfelt thanks of this Association, and of the whole people of the country, are due to Mrs. Elizabeth Thompson, of New York, and to other philanthropic individuals and associations, who by their liberal contributions have enabled the Yellow Fever Commission to prosecute its investigations; and also to those who have been concerned in organizing the work of the Commission, and in presenting the results of its work to this Association.

Before the vote on the resolution above, Hon. L. H. Steiner, M. D., delivered the following speech, in support of the same:—

The formal recognition by this Association of the Christian sympathy and practical philanthropy of Mrs. Thompson is a pleasant duty. Our chief object is to prevent disease. This cannot be secured unless we know what it is,—the mysteries of its origin and the nature of its propagation.

While the energies of the whole medical profession have been directed towards the treatment of those stricken down by the scourge that has so heavily visited our Southern States, and from the ranks of all other professions and occupations men and women have found it a high privilege to furnish such personal assistance as was in their power to the earnest physicians struggling with the disease, it was left to one of the gentler sex, in a distant State, to aid in the organization of and munificently contribute to the support of a Commission, which should pave the way to the discovery of some reliable plan for preventing its appearance hereafter within our borders. She has pointed out the path which should be trod by scientific experts, leading, we doubt not, sooner or later, to the grand discovery of such methods of prevention as will free us from visitations of this terrible disease. Recognizing, with thankful hearts, the noble, heaven-born impulse that has prompted her action, it is our privilege to place upon record some expression of high appreciation and earnest admiration.

A German poet has said, with glowing enthusiasm, —

> "Ehret die Frauen, sie flechten und weben
> Himmlische Rosen ins irdische Leben."
>
> "Honored be woman! to her it is given
> To twine with our life the sweet roses of heaven."

Aye! without her unselfish soul, her lovely ministrations, her daily illustrations of the spirit which the Master would have reflected in the life-work of his disciples, what a dreary routine of selfishness and miserable jealousies man's life would be at best! She brings the roses of heaven down to the deserts of earth, nurtures them with her prayers and her tears, and causes them to shed joy and gladness with their sweet perfume over the hearts of men. Our guide and kindly monitor in childhood's days, the cheering consoler of our riper years, the loving mother of the children to whose welfare our lives and best energies are devoted, she it is who gives life all its zest and converts the wilderness into a paradise, that furnishes us some adumbration of the unspeakable joys that belong to the brighter and better world beyond!

This noble act of Mrs. Thompson is done at a time when it will bear the richest fruit in our land. A sister has said to her brethren of the South, — it is my precious privilege to show you that others weep with you in your sorrows, pray with you by the bedsides of your dying and over the graves of your dead, sympathize with you in all your grievous afflictions, and would encourage science to speed its investigations until it shall reach such accurate knowledge as may prevent other hearts bleeding and other souls agonizing from a similar cause in the future. We are of one blood, destined, under God, to work out the grand problems that He has bound up with this country's history. We want to bind you to our hearts by ties that shall never hereafter be broken asunder. We want you to stand by our side under the glorious folds of that old flag which your fathers and our fathers first threw to the breeze, and with loving affection and earnest zeal to contend with us for the common honor and perpetual glory of the American Union.

And, sir, I feel in my soul that this act, which says this, and much more, with a silent eloquence that I cannot express in words, is eliciting now in the South that fraternal feeling, so anxiously prayed for by every patriot who loves his country, which shall bear rich fruit hereafter. I believe, sir, that the Southern heart, responsive to such feelings, must beat henceforth in perfect unison with that of the North, so that through the terrors and sufferings of war and the gloomy clouds of the pestilence, a brighter and more glorious sun than has heretofore shown upon our land shall burst forth, to cheer, invigorate, and bless the American people.

Let us draw fresh inspiration for the work that is before us by the bright example of Christian philanthropy, treasuring up with the names of those noble women, who through all time have found it more blessed to give than to receive, the name of Elizabeth Thompson.

The following papers were read by title: Prophylactic treatment of Individuals, Dr. E. M. Hunt, Secretary State Board of Health, N. J.; Geographical Elements in the Etiology of Yellow Fever, etc., Dr. Henry Hartshorne, of Philadelphia; Epidemic of 1878, with Meteorological Synopsis, Dr. C. J. Spinzig, of St. Louis; On the Relations of Water Supply and Typhoid Fever at Rochester, N. Y., Dr. Charles Buckley, Health Officer of Rochester, N. Y.

The Committee on the Treasurer's report delivered the following: —

RICHMOND, *November* 22, 1878.

The Committee to audit the Treasurer's report respectfully report that they have compared the Treasurer's account with the accompanying vouchers, and that the same correspond, and advise that the unpaid accounts be paid as by him submitted.

CHAS. A. HEWETT, *Chairman.*
J. H. RAUCH,
C. W. CHANCELLOR.
Committee.

The Association adjourned, *sine die.*

LIST OF MEMBERS ELECTED AT THE SIXTH ANNUAL MEETING.

Gen. T. A[illegible] .... Boston, Mass.
Dr. Charles A[illegible] .... [illegible]
Rev. J. G. Armstrong .... Richmond, Va.
Gen. W. [illegible] .... Richmond, Va.
T. A. A[illegible] .... Nashville, Tenn.
Dr. W. G. A[illegible] .... New Orleans, La.
James R. [illegible] .... Richmond, Va.
[illegible] R. A[illegible] .... Richmond, Va.
Dr. E. C. [illegible] .... New York City.
Dr. Paul W. [illegible] .... New Orleans, La.
Rev. S. M. [illegible], M. D. .... New Orleans, La.
Dr. [illegible] R. [illegible] .... Richmond, Va.
Thomas [illegible] .... Richmond, Va.
[illegible] .... Richmond, Va.
Dr. C. W. P. [illegible] .... Richmond, Va.
R. H. [illegible] .... Richmond, Va.
Dr. [illegible], Health Officer, Rochester, N. Y.
Rev. [illegible] .... Mobile, Ala.
[illegible] .... St. Louis, Mo.
Dr. [illegible] .... [illegible]
M. C. [illegible], Secretary State Board of
Health .... [illegible]
Dr. [illegible] .... [illegible]
Dr. W. H. [illegible] .... Mobile, Ala.
W. A. [illegible] .... Richmond, Va.
Dr. C. W. Chancellor, Secretary State
Board [illegible] .... [illegible]
Dr. E. [illegible] .... Richmond, Va.
J. [illegible] .... Richmond, Va.
L. D. Crenshaw .... Richmond, Va.
Dr. C. Shirley Carter .... Baltimore, Md.
Dr. J. S. Copes .... New Orleans, La.
Mr. Alexander Cameron .... Richmond, Va.
Rev. Dr. J. L. M. Curry, Prof. Richmond
College .... Richmond, Va.
Dr. Paul S. Carrington,
Mississippi River Quarantine Station.
Dr. J. W. Dupree .... Baton Rouge, La.
Dr. Gustavus Devron .... New Orleans, La.
John B. Davis, President Planters' Bank ....
Richmond, Va.
Isaac Davenport, President First National
Bank .... Richmond, Va.
Dr. J. J. Dement, President State Board of
Health .... Huntsville, Ala.
Greensville Dowell .... Galveston, Tex.
Dr. M. Duvall, U. S. N. .... Baltimore.
Dr. J. S. Davis .... University of Va.
Dr. William N. Elliott .... Savannah, Ga.
Dr. Landon B. Edwards .... Richmond, Va.
L. C. Fisher .... Galveston, Texas.
Dr. A. M. Fauntleroy .... Staunton, Va.
Dr. N. L. Guice .... Fayette, Miss.
Dr. Jno. B. Gaston .... Montgomery, Ala.
J. T. Gray .... Richmond, Va.
F. W. Gerses .... Richmond, Va.
Dr. James D. Galt, H. O. .... Norfolk, Va.
Dr. Richard Gundry .... Catonsville, Md.

Dr. Wm. C. W. Glazier, U. S. M. H. S.......... New York City.
Dr. J. H. Gilmore..............................
Dr. T. B. Hood................Washington, D. C.
Rudolph Hering, C. E..........Philadelphia, Pa.
Col. T. S. Hardee, C. E.........New Orleans, La
Dr. Jno. B. Hamilton.......U. S. M. H. Service.
W. W. Henry......................Richmond, Va.
N. D. Hargrove...................Richmond, Va.
Rev. Dr. M. D. Hoge..............Richmond, Va.
D. J. Hartsook...................Richmond, Va.
Philip Havall.....................Richmond, Va.
Dr. J. C. Habersham...............Savannah, Ga.
Dr. R. B. Hargis..................Pensacola, Fla.
Dr. G. E. H. Harman................U. S. Navy.
Dr. W. T. Hope................Chattanooga, Tenn.
Hon. Eli I. Henkle...............Baltimore, Md.
Dr. S. S. Herrick...............New Orleans, La.
Dr. W. H. H. Hutton, U. S. M. H. S...... New Orleans, La.
Dr. D. C. Holliday.............New Orleans, La.
Dr. James F. Harrison..........University of Va.
Dr. D. W. Hand......................U. S. Army.
Dr. O. S. Iglehart...................Mobile, Ala.
Dr. Bushrod W. James..........Philadelphia, Pa.
Rev. Dr. J. B. Jeter...............Richmond, Va.
Dr. L. S. Joynes..................Richmond, Va.
Genl. Joseph E. Johnston.........Richmond, Va.
Heber Jones.....................Memphis, Tenn.
John A. Judson....................Newport, R. I.
Dr. Wirt Johnston, Secretary State Board of Health...........................Jackson, Miss.
Dr. J. H. Kellogg............Battle Creek, Mich.
Dr. R. A. Kinlock..............Charleston, S. C.
George Lee........................Richmond, Va.
Dr. H. H. Levy....................Richmond, Va.
Dr. W. H. Long, U. S. M. H. S.....Louisville, Ky.
Dr. D. S. Lyon....................Charlotte, N. C.
Dr. Robert Libby................Charleston, S. C.
Dr. Charles Mayill..............Manchester, Va.
Rev. Dr. C. K. Marshall.........Vicksburg, Miss.
Dr. R. F. Michel..............Montgomery, Ala
Dr. T. A. Means................Montgomery, Ala.
R. H. Meade......................Richmond, Va.
Dr. S. P. Moore...................Richmond, Va.
Judge J. A. Meriditih.............Richmond, Va.
Dr. James B. McCaw..............Richmond, Va.
T. W. McCaine....................Richmond, Va.
Robert W. Mitchell.............Memphis, Tenn.
Dr. Wm. H. Mullins..........Chattanooga, Tenn.
Hon. Robert M. McLane.........Baltimore, Md.
Prof. J. B. Minor................University of Va.
Dr. William H. Mussey...........Cincinnati, O.
Prof. R. S. McCulloch..........Baton Rouge, La.
E. O. Nolting, President National Bank of Virginia..........................Richmond, Va.

Dr. H. M. Nash, Quarantine Medical Officer...... Norfolk, Va
John Ott..........................Richmond, Va.
Dr. David Prince................Jacksonville, Fla.
J. B. Purcell.....................Richmond, Va.
J. B. Pace.........................Richmond, Va.
Dr. Joseph Y. Porter, Assistant Surgeon U. S. Army..................Fort Jefferson, Fla.
Dr. J. D. Plunket...............Nashville, Tenn.
Prof. J. R. Page.................University of Va.
Maj. Green Peyton..............University of Va.
Dr. George S. Pelzer, City Registrar............ Charleston, S. C.
Dr. J. H. Raymond, Sanitary Superintendent...... Brooklyn, N. Y.
Dr. Deering J. Roberts.........Nashville, Tenn.
Dr. S. D. Robbins..............................
A. Y. Stokes.......................Richmond, Va.
Dr. Charles H. Smith.............Richmond, Va.
Dr. William Selden.................Norfolk, Va.
P. H. Starke......................Richmond, Va.
Dr. W. G. Stevenson........Poughkeepsie, N. Y.
Maj. E. B. Smith..................Richmond, Va.
Prof. F. H. Smith, University of Virginia......... Charlottesville.
Hon. A. H. H. Stuart..............Staunton, Va.
William J. Smith................Memphis, Tenn.
Dr. P. D. Sims.................Chattanooga, Tenn.
O. B. Smith.......................Portsmouth, Va.
Dr. C. M. Sitman................Greensburg, La.
Dr. J. Howard Taylor..........Philadelphia, Pa.
Hon. J. Randolph Tucker.........Lexington, Va.
Prof. H. N. Todd....................U. S. Navy.
Dr. J. Rufus Tryon..................U. S. Navy.
Dr. George E. Trescott........Charleston, S. C.
Prof. William P. Toury...........Baltimore, Md.
Dr. H. Taylor...................................
Mrs. Elizabeth Thompson........New York City.
James Thomas, Jr..................Richmond, Va.
Col. C. S. Venable, University of Virginia...... Charlottesville, Va.
Prof. Schele de Vere, University of Virginia...... Charlottesville, Va.
Dr. Isaac H. White...............Richmond, Va.
Dr. J. S. Wellford................Richmond, Va.
Dr. H. W. Williams................Boston, Mass.
Dr. William R. Weisiger........Manchester, Va.
Dr. J. S. Weatherly...........Montgomery, Ala.
Dr. Robert White, Jr., U. S. Marine Hospital Service...................Philadelphia, Pa.
W. T. Walthall.....................Mobile, Ala.
R. H. Webb......................Livingstone, Ala.
Dr. Thomas F. Woods...........Newbern, N. C.
Dr. J. R. Ward.................Gowanstown, Md.
Hon. S. Teackle Wallis.......... Baltimore, Md.
Dr. R. D. Webb..................Livingston, Ala.

APPENDIX.

THE following letter from Dr. L. S. Joynes of Richmond, Va. was read at the meeting of the Executive Committee held in Washington, D. C., January 2, 1879.

RICHMOND, VA., *December* 26, 1878.

DR. JOHN S. BILLINGS, Surgeon U. S. A.,

Vice-president American Public Health Association, Washington, D. C.

Dear Sir: I am in receipt of a circular letter addressed by Prof. J. L. Cabell, President of the American Public Health Association, under date of December 10, to the members of the "Advisory Committee" appointed at the late meeting of the Association in this city, in relation to certain proposed measures of Congressional legislation. In this circular it is suggested that the members of the Advisory Committee meet in Washington at or before the time fixed for the meeting of the Executive Committee (January 2, 1879), and that such members of the Committee as may be unable to attend such meeting communicate their individual views by letter addressed to yourself. As it is altogether probable that it will not be in my power to visit Washington at the time indicated, I beg leave to submit a few remarks on the main subjects referred to in the circular, without undertaking to discuss any of them thoroughly.

First, as to a "*proper quarantine*," and the *power of the General Government* in relation thereto.

I am strongly impressed with the belief that no system of quarantine against yellow fever and other exotic diseases will ever prove effective, that is not ***national*** in character — that is, established and maintained by the common central authority of the General Government. In such a matter, a substantial ***unity*** of plan and of execution is manifestly of the first importance. One kind of quarantine at one port, and a very different and perhaps mistaken kind at another, — strictness of execution here, and utter laxity there, — will not constitute such a system as the protection of the public health imperatively demands. To answer its legitimate ends, the system must be *equally effective everywhere*. It is hardly possible — certainly it is not within the range of reasonable probability — that such uniform effectiveness can ever be attained under the separate action of the several States and their municipalities. If state legislation is to govern the matter, there are ***nineteen*** different States having seaports situated on or near the Atlantic and Gulf coasts, and therefore possibly liable to the introduction of yellow fever from infected ports. Indeed, in eighteen of those States (all but Maine), the disease has actually prevailed in epidemic form. Is harmony of action to be looked for among so many separate governments? The past and present state of legislation in the several States with reference to sanitary matters in general certainly does not justify such hope.

If the subject of quarantine be committed by the State authorities to those of the maritime cities and towns, is not the chance of diverse and inconsistent action still greater, in view of the large number of such cities and towns which may be exposed to danger, and which may have to invoke the protection of quarantine?

That there are indeed important differences in the mode of conducting quarantine in the different states and seaports, and that in some of them it is lamentably defective — "existing only in name" — is so well known, that I deem it qnite needless to adduce evidence of the fact. Varying degrees of knowledge (or ignorance) of the subject, varying opinions, traditions, prejudices, sometimes the potent influence of local and rival interests, have naturally led to such divergence of results in the past and will no doubt continue to do so in the future, if still allowed control.[1] The only possible remedy for this unfortunate state of things is the intervention of the General Government. *A common system must spring from a common centre, and be controlled by a common power.*

If the ravages of yellow fever were always confined to the locality first invaded by it, the evils arising from the want of a common system would not be so great, since the penalties for mistake or negligence in the matter of quarantine would fall only where they belonged. But manifold experience, especially that of the recent epidemic, has shown only too well that when yellow fever has once gained a foothold at a single point on our shores, no limit can be placed to its possible diffusion. Under favoring circumstances, it is so readily conveyed along the lines of human intercourse, by river or by rail, that centres of population a thousand miles distant are not safe. The danger, then, is truly *national;* and the measures of protection ought to be equally national. Is it wise to intrust to the local authorities of any port of entry, whether great or small, the tremendous responsibility of deciding whether the entire country shall be imperilled by the risks which they may choose to run for fear of injuring their own trade?

In considering the expediency of a change of system, it should not be forgotten that one obstacle to the establishment of an effective quarantine is its *cost.* There is always danger that a State or a city crippled by financial embarrassment (as are some of those in the very section of our country most exposed to the inroads of yellow fever), may fail to provide adequate means for an effective system. But the plea of poverty and enforced economy could not be raised by the General Government. Its revenues can amply afford whatever expenditure may be necessary for the protection of the country against the ravages of a destructive pestilence. And why should they not bear this burden? If as just now remarked, *the danger is national, so also ought to be the cost of guarding against it.*

But further: *the revenue derived from foreign commerce goes into the national treasury.* Does not plain justice therefore dictate that the expense of obviating the evils and dangers which may result from that commerce should be defrayed out of the same treasury? Setting aside all considerations of humanity, and viewing the question merely as one of national finance, the Government would no doubt be the gainer by assuming the charge of an efficient quarantine system. Every serious outbreak of yellow fever — especially such a one as that of 1878 — necessarily injures in a greater or less degree both the foreign and domestic trade of the country, and the revenues of the Government must suffer in the like proportion. I have no data for estimating the loss to the Government in various ways occasioned by the epidemic of the past season; but I have little doubt that, if it could be accurately

[1] It is quite conceivable that the authorities of a particular town might refuse to take any steps at all in the matter of quarantine, notwithstanding the existence of an obvious danger — whether under the influence of the belief, once entertained by eminent authorities, and not yet wholly extinct, that yellow fever is never imported, but always of local origin, or because of a blind confidence in the immunity of such town from the assaults of the pestilence. It seems to have been under the influence of the latter delusion that the Council of the City of Richmond, during the last summer, refused to establish a quarantine, or to appropriate one dollar to enable its Board of Health to take any precautionary measures against the introduction of yellow fever.

ascertained, the amount would be found more than sufficient to meet the annual cost of an effective national quarantine.

These considerations ought to furnish a sufficient reply to the argument which some will be sure to urge against such a system on the score of expense. But even if the saving to the Government did not equal the outlay, such objectors should remember that the expense of maintaining a proper system of quarantine must fall *somewhere*, and that various and weighty reasons exist why it should not fall exclusively upon a few communities. It would be quite as just and reasonable to expect them to bear the whole cost of defending themselves against an invading force, in time of war between this country and a foreign power.

The foregoing are the principal reasons which appear to me to justify and compel the conclusion that the only just, proper, and effective system of quarantine, (if one *can* be made effective against yellow fever), must be one controlled, directed and maintained by the General Government. It may not be amiss to state here that resolutions embodying this conclusion were adopted by the Medical Society of Virginia at its last annual meeting, in October, 1878, and that copies of the same were ordered to be forwarded to each of the Senators and Representatives of Virginia in Congress, as well as to the Governor of the Commonwealth.

Whether the General Government can constitutionally assume control of the subject of quarantine, is a question for the statesman and constitutional lawyer to decide ; and it may seem presumptuous for a medical body to discuss it. But as this is one of the points presented in the circular addressed to the members of the Advisory Committee, I will briefly mention a few considerations which appear to justify us in not taking the negative of the question for granted, and in hoping that a deliberate consideration of the subject by Congress may lead to an affirmative decision.

The Constitution confers upon Congress the power "to regulate commerce with foreign nations, among the several States, and with the Indian tribes." It would seem clear that under this provision Congress has power to adopt such regulations regarding foreign commerce as may foster and encourage it, may increase its benefits to the country, or on the other hand *may obviate or lessen the evils and dangers which may be attendant upon it.* That Congress has often, without dispute, enacted measures affecting foreign commerce, with the latter object in view, can easily be shown. It has legislated for the protection of emigrants against the dangers of over-crowding in ships, by providing that a certain space shall be allowed to each passenger, and adopting other regulations concerning their transportation. It has caused the erection of numerous hospitals for the reception of sick seamen of the mercantile marine, and established a fund for the maintenance of such hospitals by levying a tax on every seaman. Congress has done this, although marine hospitals are nowhere mentioned in the Constitution, — it is under the power *to regulate commerce* that these provisions for the care of sick seamen have been adopted.

Again, Congress has caused the erection of numerous life-saving stations, for the rescue of the crews and passengers of vessels from the dangers of the coast — though here again there is no express constitutional provision that warrants the measure, but only the general power to regulate commerce.

With the view of preventing the introduction of infectious cattle-diseases into the country, a law of Congress forbids the importation of cattle at certain seasons of the year from localities where such diseases are prevailing. Here we have a regulation of commerce of a character closely corresponding to that which constitutes ordinary quarantine.

It appears, then, that Congress may regulate and, if need be, restrict commerce for the protection of the crews and passengers of sea-going vessels, and of seamen in general, and may even legislate under the same power to prevent the introduction of disease among our cattle. What is it to be thought of a political theory which denies to Congress the power to regulate commerce for the exclusion of a pestilence which often destroys thousands of our population, and which menaces our seaports almost every year? In comparison with the ravages of yellow fever in our cities and towns, what is the loss of a few hundred lives on emigrant ships, the occasional loss of life by shipwreck, or the destruction even of many thousands of cattle by the *rinderpest?* To say that Congress may combat the lesser evils and dangers, by the necessary regulations or restrictions of commerce, but must eave the greater untouched, is to assert what strikes an unbiassed mind as in the highest degree unreasonable, if not absurd. It cannot be that the Constitution, which *takes from the States* the power to regulate commerce, by conferring it upon Congress, at the same time withholds from the latter discretion of so regulating it as to protect the health and lives of the forty millions of our people.

Will any one contend that Congress would not have power to prohibit the importation of cargoes of *rags* known or believed to be infected with *small-pox?* It is presumed not. Yet such an exercise of power would be the same as that involved in the enforcement of quarantine against vessels and cargoes infected with the poison of yellow fever.

Much more might be said on this question, but this communication already exceeds the limits proposed at the outset.[1]

I do not propose to discuss the details of the quarantine system which should be adopted, in the event that Congress shall decide that it has power to act in the premises. My want of practical familiarity with the subject must be my excuse for leaving the discussion of it to others. In my opinion the arrangement of the details of a plan would best be left to a commission of *experts* — that is to say, of medical men who have become familiar by experience with the practical operation of the system of quarantine as at present pursued at our principal seaports (or some of them), who are acquainted with its advantages and its defects, and are therefore qualified to judge what modifications and improvements may be desirable.

The supervision and direction of the national quarantine must of course be intrusted to an officer or a board attached to one of the departments at Washington. Probably a board consisting of three or five members would be best — both civil practitioners and the medical officers of the Government being represented in such board.

Some discussion will doubtless arise with reference to the particular Department to which this quarantine board shall be assigned. Inasmuch as the power of the Government in this matter is derived from the power to regulate commerce, the logical inference would seem to be that the chief direction should be given to the Treasury Department. Reasons of expediency may, however, render a different arrangement preferable.

[1] If an adverse argument should be drawn from the fact that Congress has not heretofore exercised the power here contended for, the obvious answer is that *the failure to exercise a power, for whatever period of time, does not forfeit the power.* Until recently, Congress did not see fit to exercise the power to fix the time for the election of members of the House of Representatives; but that power remained unimpaired by lapse of time, until Congress thought proper to assume control of what had formerly been left to the States.

It need hardly be added that if Congress possesses power over *external* quarantine, it possesses in an equal degree the power to establish an *inter-state quarantine,* or to regulate trade and travel among the several States with a view to preventing the diffusion of a pestilential disease: For the Constitution empowers Congress to regulate commerce "among the several States," as well as with foreign nations.

Another subject referred to in the circular of Professor Cabell, is the proposition of Dr. H. B. Baker, of Michigan, to endeavor to obtain from Congress the establishment of a permanent *Sanitary Bureau* in connection with one of the Departments of the General Government.

After due consideration of this subject, I venture to express a strong doubt as to the expediency of pressing it upon Congress at this time. I freely admit the desirableness of such a measure; but to urge it now might endanger the success of the movement for a national quarantine. To ask for both at once might very possibly result in the defeat of both. It must be borne in mind that the arguments for the constitutional power of Congress is by no means so strong in the one case as in the other. While in the case of quarantine we can appeal to an obvious and and all-sufficient authority in the power to regulate commerce, it is difficult to discover anywhere in the Constitution either a direct or indirect grant of power to Congress over *internal sanitary matters*—such as are dealt with by State and city boards of health. I would not object, however, to pressing this question at a future time: I am quite willing to see the powers of Congress *stretched* a little to attain such an important end. But let us first make sure, if we can, of the national quarantine, which is the more immediately important, as well as the more likely to meet the favor of Congress: hereafter we may give the National Sanitary Bureau its turn. and with a better chance of success, especially if the national quarantine shall be found to work well.

Respectfully and truly yours, L. S. JOYNES.

ERRATA.

Page 116. After the title, insert

A PAPER READ AT THE CHICAGO MEETING, SEPT. 26, 1877.

Page 129. After the title, insert

SUBMITTED AT THE CHICAGO MEETING.

Page 210. Seventh and fourteenth lines, for Minion, read Mission.

Page 231. Name of author, for G. W. Austin, read W. G. Austin.

Page 243. After the title, insert

READ AT THE RICHMOND MEETING, NOV. 21, 1878.

Page 240. After the title, insert

SUBMITTED AT THE RICHMOND MEETING.